

A Drinking Water Quality Framework for South Africa



December 2005



PREFACE

This Framework forms part of a series which is intended to provide the water sector with the information needed to monitor, manage, communicate and regulate drinking water quality in order to protect public health.

The [Drinking Water Quality Framework for South Africa](#) is the overarching document in the series and includes information on Drinking Water Quality Management and Regulation, as well as the institutional arrangements necessary to implement the strategies presented in the Framework.

The following documents form the series:

A Drinking Water Quality Framework for South Africa



Drinking Water Quality Management Guide for Water Services Authorities



Drinking Water Quality Regulation Strategy



Water Services Authority Awareness Pamphlet



Disinfection Awareness Pamphlet



Consumer Awareness Pamphlet



For further information on Drinking Water Quality, or copies of the documents in the series, please contact:

- ❖ The Department of Water Affairs and Forestry: Water Services Regulation on (012) 3366600, or the website: <http://www.dwaf.gov.za>.



EXECUTIVE SUMMARY

Access to safe drinking water is a basic human right and essential to people's health. Safe drinking water that complies with the South African National Standard (SANS) 241 Drinking Water Specification does not pose a significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages (babies and infants, the immuno-compromised and the elderly). Improving access to safe drinking water can thus result in tangible benefits to public health and every effort should be made to achieve a drinking water quality that complies with national safety standards.

Current investigations show that an unacceptably high incidence of poor drinking water quality occurs in non-metro South Africa. Reasons for failure of drinking water standards include:

- ❖ A lack of understanding by Water Services Authorities (WSAs) regarding the requirements for effective Drinking Water Quality Management;
- ❖ Inadequate management including monitoring of drinking water services;
- ❖ Inadequate infrastructure management;
- ❖ Inadequate WSA institutional capacity (staffing, funding, expertise, education), and
- ❖ Lack of interventions to address poor drinking water quality when detected.

In recognition of these challenges, a Drinking Water Quality Framework is proposed for South Africa to enable effective management of drinking water quality to protect public health.

The Framework is based on an integrated system of approaches and procedures which address the key factors that govern drinking water quality and safety in South Africa:

Commitment to Drinking Water Quality Management and Multi-stakeholder Involvement

Successful implementation requires the support and commitment of all water sector stakeholders. The Department of Water Affairs and Forestry (DWAF), as the lead institution for the regulation of drinking water quality in South Africa, is required to provide sector leadership and interact with all key stakeholders to ensure the development and operation of appropriate mechanisms for effective delivery of safe drinking water. Sector collaboration, *via* Provincial Task Teams and Fora with appropriate stakeholder representation, will enable effective Drinking Water Quality Management by ensuring clear definition and documentation of roles and responsibilities of the different spheres of government and other stakeholders.

System Analysis and Management

Effective management requires an understanding of the entire water supply system (from the catchment and its source water, through to the consumer, and back into the water system), an assessment of the hazards and events that can compromise drinking water quality, and the implementation of preventative measures and operational controls necessary for ensuring safe and reliable drinking water.

As part of the drinking water system management, Water Services Authorities are required to undertake operational monitoring, used as a trigger for immediate short-term corrective actions to operational procedures as required, and drinking water quality compliance or verification monitoring to check that the barriers and preventative measures implemented to protect public health are working effectively.

A Drinking Water Failure Emergency Response model comprising three Alert Levels is proposed to respond to acute drinking water quality failures:

- ❖ Alert Level I: Routine problems including minor disruptions to the water system and single sample non-compliances (Internal Water Services Authority response only);
- ❖ Alert Level II: Minor emergencies, requiring additional sampling, process optimisation and reporting/communication of the problem (Internal Water Services Authority response only);



- ❖ Alert Level III: Major emergencies requiring significant interventions to minimise public health risk (Engagement of an active Emergency Management Team).

Supporting Programmes

Support for effective Drinking Water Quality Management includes basic elements of good practice to ensure that the system has the capacity to operate and adapt to meet challenges. This includes training of employees within the water sector, community involvement and awareness creation, research and development, validation of process efficacy, and documentation and reporting systems.

A Drinking Water Quality Management Information system, aligned with existing DWAF data management systems, is proposed to facilitate drinking water quality data management to a wide range of stakeholders and, in particular, allow active participation by consumers.

In acknowledgement of institutional capacity problems, a number of possible funding mechanisms are presented to support WSAs.

Review

Ongoing evaluation of water quality data and audit processes to ensure that the management system is operating satisfactorily, provides a basis for continual improvement. DWAF, as the sector regulator, is required to undertake Drinking Water Quality Management System Regulatory Audits where a wide-ranging assessment of sector performance (including compliance to national norms and standards) is recommended to be undertaken. A set of agreed Drinking Water Quality Management Key Performance Indicators, Measures and Targets is required to be developed to assess WSA performance when implementing the Drinking Water Quality Management System Regulatory Audit.

Implementation of the Framework

The current situation in South Africa is that many Water Services Authorities do not undertake their mandated requirements of drinking water quality monitoring, management and communication, and most Water Services Authorities fall far short of the vision of 'Effective Drinking Water Quality Management Ensuring Safe Drinking Water'. Due to the need for immediate action, the perceived lack of resources and capacity within the WSAs to conduct the required drinking water quality monitoring and management, and the perceived lack of understanding of the WSAs regarding governance requirements, responsibilities and accountabilities, both short- and medium-term intervention strategies and a longer term Drinking Water Quality Management Strategy are necessary.

A phased approach should be adopted to ensure that:

- ❖ Areas of severe failure are identified and addressed in the immediate short term;
- ❖ Early wins are secured in the short term, thereby demonstrating the inherent value of the approach, and
- ❖ Coordinated development and implementation of a Drinking Water Quality Regulation Strategy over the longer term is possible.

This approach will limit the disruption of existing operational procedures whilst ensuring an effective service to stakeholders.

Short-term Intervention Strategy

The goal of 'Improved Drinking Water Quality Soonest' will be implemented *via* a number of short-term actions, to be implemented within one year.

Action 1: Highlighting the profile of Drinking Water Quality Management at Provincial Service Delivery Fora

It is proposed that at a provincial level, the profile of Drinking Water Quality Management is raised to drive improved delivery of safe drinking water. Where Service Delivery Fora currently exist, Drinking Water Quality



Management is recommended to be formally admitted onto the agenda for attention. Where Fora do not yet exist, it is recommended that they be established to address provincial drinking water quality issues. These Fora should allow for the involvement and full participation of all stakeholders.

A Task Team is proposed to initiate and oversee the formation of the Drinking Water Quality Management Forum, or to modify existing fora to highlight the profile of Drinking Water Quality Management. The Task Team will comprise senior representatives of at least the following key sector members:

- ❖ DWAF Regional Office;
- ❖ Provincial Department of Local Government;
- ❖ Provincial Department of Health, and
- ❖ SALGA.

The Task Team will be led by an agreed 'Lead Agent', with the default Lead Agent being DWAF Regional Office. An alternate Lead Agent may, however, be determined by the Task Team, dependant on the relative strengths and existing sector initiatives.

Action 2: Awareness Creation and Communication of Responsibilities for Urgent Cases

A Drinking Water Quality Management Communication Campaign is planned, including:

- ❖ A pamphlet to inform WSAs of their duty to undertake monitoring and communication as dictated by the regulated Compulsory National Standards, as well as the minimum requirements for effective Drinking Water Quality Management;
- ❖ A pamphlet to increase consumer awareness of Drinking Water Quality issues, and
- ❖ Provincial roadshows to communicate the Drinking Water Quality Framework to all sector stakeholders, and obtain feedback to improve the document.

Action 3: Support and Intervention

Where evidence exists that a WSA is providing water of unacceptable quality, or where the WSA is not undertaking any water quality monitoring, the Regional Director: DWAF will communicate *via* a letter to the Municipal Manager pointing out the WSA's responsibilities and offering assistance in a supportive manner. This support will include advising on the WSA's regulatory requirements, provision of an information pack on Drinking Water Quality Management, and provision of practical guidelines for implementation of effective Drinking Water Quality Management. In cases of severe drinking water quality failure, emergency response will also be instituted.

Medium-term Intervention Strategies

Drinking water quality will be improved by the implementation of two medium-term actions, to be executed within two to three years:

Action 4: Implementation of Drinking Water Situational Assessments

Action 4a: A once-off baseline assessment of drinking water quality should be undertaken to gather current data from all WSAs as well as to inform them of their requirement to undertake systematic monitoring and communication of drinking water quality results as specified in the regulated Compulsory National Standards.

Action 4b: DWAF is recommended to undertake Drinking Water Quality Management System assessments where a wide-ranging assessment of WSA performance is conducted. This assessment will be used to indicate the level of support required from Provincial & National Government.

Action 5: Initiation of Provincial Drinking Water Quality Consultative Audits

Since many WSAs do not adhere to the Compulsory National Standards for the Quality of Potable Water, a process needs to be initiated by Provincial or National Government to rectify the situation. Consultative audits, similar to those practised monthly in the Free State, need to be initiated in each province. These co-operative governance-oriented drinking water quality audits will not replace the required drinking water quality



monitoring and self-regulation to be undertaken by WSAs or the recommended regulatory audits undertaken by DWAF, but are seen as an interim supportive measure to be undertaken until capacity is built at the local level and Water Services Authorities can undertake their mandated requirements of drinking water quality monitoring, management and communication.

Information arising from the Consultative Audits should be:

- ❖ Communicated to Provincial Drinking Water Quality Management Fora, where the problem areas identified through the above process are discussed and prioritised (ranked). These audits can be used to determine required regulatory intervention, assess progress with achieving drinking water quality compliance, and recommend Municipal Infrastructure Grant (MIG) and Capacity Building Grant (CBG) funding where capacity is lacking.
- ❖ Captured onto a DWAF Drinking Water Quality Management database and made available *via* an internet based system.

Longer Term Drinking Water Quality Management Strategy

To achieve the longer term vision of 'Effective Drinking Water Quality Management Ensuring Safe Drinking Water', WSAs are required to fulfil their mandated requirements of drinking water quality monitoring, management and communication, with DWAF fulfilling the role of National Policy-maker, Supporter and Regulator.

The ideal long-term Drinking Water Quality Management objective is that:

- ❖ WSAs are supported to undertake effective Drinking Water Quality Management from catchment to consumer, using a comprehensive, preventative risk-management approach, ensuring safe drinking water and protection of public health. As verification of the performance of their Drinking Water Quality Management system, WSAs are required to undertake drinking water quality compliance monitoring, at frequencies appropriate to factors such as the population served, the volume of water treated and the frequency of water quality problems. The purpose of this monitoring is to provide confidence in the provision of safe drinking water. However, in recognition of limited capacity within WSAs, the minimum requirements for effective management of Drinking Water Treatment have also been proposed.
- ❖ The Provincial Consultative Audits are gradually phased out in provinces which demonstrate effective Drinking Water Quality Management. The frequency of consultative auditing is recommended to decrease with increasing conformance to the Water Services Act (No. 108 of 1997) monitoring requirements and compliance with the SANS 241 Drinking Water Specification.
- ❖ DWAF, as the sector regulator, is recommended to undertake Drinking Water Quality Management Regulatory Audits, where a comprehensive assessment of Drinking Water Quality Management is undertaken. These Regulatory Audits will be aligned with the overall Regulatory Strategy for the regulation of Water Services, and are likely to be random and uncheduled, with an emphasis on verified self-reporting by WSAs.
- ❖ Where there is lack of adherence to the monitoring requirements specified in the Water Services Act (No. 108 of 1997), or there is evidence of drinking water quality problems of an acute or chronic nature, it is recommended that DWAF intervene in a proactive manner according to the Drinking Water Quality Regulatory Strategy. In cases of severe drinking water quality failure, emergency response will also be instituted.



Drinking Water Quality Management Regulation: Incentives and Sanctions

The Department of Water Affairs and Forestry is committed to performing its role as Sector Regulator in a supportive and developmental manner. When capacity problems are identified that may prevent a Water Services Authority from being compliant, avenues of support will be explored until such time that the WSA is capable of being compliant. The focus is thus on incentive-based regulation. However, in cases of reluctance or negligence by the WSA management to rectify identified non-compliant activities relating to Drinking Water Quality Management, while being capable of doing so, then punitive actions will be considered.



LIST OF ABBREVIATIONS

CBG	Capacity Building Grant
CBO	Community Based Organisation
CMA	Catchment Management Agency
CMF	Catchment Management Forum
DoH	Department of Health
DLG	Department of Local Government
DPLG	Department of Provincial and Local Government
DWAF	Department of Water Affairs and Forestry
DWQ	Drinking water quality
DWQM	Drinking Water Quality Management
ESETA	Energy Sector Education and Training Authority
MIG	Municipal Infrastructure Grant
NDMC	National Disaster Management Centre
NGO	Non-Governmental Organisation
NWA	National Water Act
NWRS	National Water Resources Strategy
PHAST	Participatory Hygiene and Sanitation Transformation
SAAWU	South African Association of Water Utilities
SALGA	South African Local Government Association
SANS	South African National Standard
SMIF	Special Municipal Infrastructure Fund
SWOT	Strengths, Weaknesses, Opportunities and Threats
WRC	Water Research Commission
WSA	Water Services Authority
WSDP	Water Services Development Plan
WSP	Water Services Provider



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1. INTRODUCTION

1.1 BACKGROUND AND SOUTH AFRICAN CONTEXT

Access to safe drinking water is essential to health and is a basic human right. Safe drinking water that complies with the South African National Standard 241 Drinking Water Specification does not pose a significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages (babies and infants, the immuno-compromised and the elderly). Improving access to safe drinking water can thus result in tangible benefits to public health and every effort should be made to achieve a drinking water quality that complies with national safety standards.

Since 1994, significant progress has been made in the provision of basic services, including drinking water and sanitation. However, notwithstanding this progress, service delivery backlogs still exist in key areas including the provision of safe drinking water. The quality of the drinking water being provided at point-of-use is of vital consideration. Current investigations have shown that in many instances drinking water in non-metro South Africa does not meet the required drinking water quality standards (Manxodidi *et.al.*, 2004).

In recognition of these challenges, a Drinking Water Quality Framework has been prepared to enable effective management of drinking water quality in South Africa to protect public health. The Framework presents an integrated system of approaches and procedures to address the key factors that govern drinking water quality protection in South Africa.

1.2 ENABLING LEGISLATION

The primary health impact of drinking water quality is well recognised, and has resulted in development of substantial enabling legislation, frameworks and strategies relating to the provision of water services.

Key references relating to the provision of safe drinking water in South Africa include:

- ❖ **Water Services Act** (No. 108 of 1997) - The Water Services Act gives substance to constitutional requirements with respect to access, national norms and standards and the institutional framework for the provision of water services;
- ❖ **Compulsory National Standards for the Quality of Potable Water** (2001, Regulation 5 of Section 9 of the Water Services Act) - requires that WSAs implement drinking water quality monitoring programmes to monitor, improve and report on drinking water service delivery;
- ❖ **Strategic Framework for Water Services** (2003) - The Strategic Framework contains guidelines for the provision of water services, including drinking water quality, and role of DWAF as sector regulator;
- ❖ **Municipal Structures Act** (No.117 of 1998) - This Act provides for functions and powers of municipalities and other local government structures, of which water services is one of many primary functions;
- ❖ **National Health Act** (No. 61 of 2003) - This Act promotes fulfilling the rights of people of South Africa to an environment that is not harmful to their health or well being;
- ❖ The **National Water Act** (No.36 of 1998) is the principal legal instrument relating to water resources management in South Africa and contains comprehensive provisions for the protection, use, development, conservation, management and control of South Africa's water resources, and
- ❖ The **National Water Resources Strategy** (2004) provides the framework within which water resources will be managed throughout the country. The National Water Resources Strategy also provides the framework within which all catchment management strategies will be prepared and implemented for water resources management in a water management area.



2. CURRENT STATUS OF DRINKING WATER QUALITY MANAGEMENT IN SOUTH AFRICA

2.1 EXISTING STATUS

The current status of Drinking Water Quality Management in South Africa is summarised in the *Initiation of a National Drinking-Water Quality Strategy (2004)* as follows:

- ❖ Most Water Services Authorities (WSAs) do not understand what is required for effective drinking water service delivery. Specific findings include:
 - There is a lack of understanding of legislative requirements, drinking water quality standards/guidelines, and requirements for effective management and monitoring.
 - Service delivery to smaller towns/communities in non-metropolitan areas is not as effective and efficient as that in the larger towns of the same WSA.
- ❖ Inadequate management and monitoring of drinking water services by WSAs consistently results in drinking water quality that fails legislated requirements. Specific findings include:
 - Lack of drinking water quality data;
 - Lack of basic laboratory equipment for testing of samples;
 - Drinking water quality is not always compliant with standards or acceptable for lifetime consumption;
 - Lack of awareness that water quality issues can be identified through monitoring, and
 - Accurate laboratory analysis is essential to enable informed decision-making.
- ❖ Inadequate infrastructure management results in premature failure of drinking water services. Specific findings include:
 - Maintenance budgets are not adequate to ensure adequate maintenance;
 - Appropriate technologies are not always implemented, and
 - Vandalism has a direct impact on service delivery and service sustainability.
- ❖ Present WSA institutional capacity (unqualified and inexperienced staff) is resulting in inadequate service provision.
- ❖ Lack of interventions to address poor drinking water quality compliance with legislated requirements.

(Manxodidi *et al.*, 2004)

2.2 REGIONAL SITUATIONAL ASSESSMENT: RAPID REVIEW TO IDENTIFY KEY PROVINCIAL DRIVERS

The new South Africa is faced with difficult and pressing challenges relating to the provision of adequate water services. In this regard, the Department of Water Affairs and Forestry (DWAF) plays an overall regulatory governance role in guiding Local and Provincial government *via* supportive interventions and the development of necessary guiding policies. A key initiative is the development and roll-out of a National Drinking Water Quality Framework. This Framework should consider and build on existing Best Practices. As the National Drinking Water Quality Framework is currently being formulated, a rapid review and assessment of the *status quo* of regional drinking water quality monitoring and management and existing role players in each province was required.

The objectives of the study were to:

- ❖ Conduct a baseline study comprising a review of existing data on the regulatory compliance by WSAs;
- ❖ Identify key regional role players (other than WSAs);
- ❖ Summarise the Strengths, Weaknesses, Opportunities and Threats with regards to Drinking Water Quality Management in each province;
- ❖ Identify key drivers contributing to the existing regional Drinking Water Quality Management practices in each province;



- ❖ Identify and describe Best Practices, and
- ❖ Provide insights into what could work optimally in each province.

2.2.1 Key Regional Role Players and Methodology

The following key regional role players (other than WSAs) were identified as part of the study:

- ❖ Department of Water Affairs and Forestry (management and regulation of water services including drinking water quality);
- ❖ Department of Health (health risk management and related awareness);
- ❖ Department of Local Government and Housing (direct support to municipalities), and
- ❖ Water Boards (Water Services Providers where applicable).

Although every attempt was made to interview the identified key role players in each province, the rapid nature of the study meant that, in some cases, not all inputs could be obtained. Provincial Strengths, Weaknesses, Opportunities and Threats (SWOT) analyses were performed *via* both existing base line information and interviews with key regional role players. Key drivers and existing best practices were also identified and ranked.

2.2.2 Key Issues arising from Rapid Review

From the findings of the rapid review, the following key issues have been identified as being critical to achieving effective Drinking Water Quality Management:

- ❖ Need for a raised awareness of drinking water quality within civil society and within political structures;
- ❖ National and provincial Drinking Water Quality Management champions are required to provide leadership and ensure provincial sector progress;
- ❖ WSAs need improved understanding of regulatory requirements relating to Drinking Water Quality Management;
- ❖ Increased need for Drinking Water Quality Management-orientated personnel at provincial and local government level;
- ❖ Need for a provincial sector Fora focusing on drinking water quality issues;
- ❖ Clear understanding and allocation of provincial key stakeholder roles and responsibilities;
- ❖ Drinking water quality data must be easily accessible to all stakeholders;
- ❖ Accessible, accurate analytical support is required to service WSAs;
- ❖ Simple, structured, adequate Drinking Water Quality Management programmes are required to be operated by those responsible for water services provision;
- ❖ Water quality monitoring undertaken by Environmental Health Practitioners needs to be restructured to be of useful input to WSAs (presently seen as remote from optimisation of operational issues and challenges);
- ❖ Community awareness needs to increase and data must be managed and communicated appropriately, and
- ❖ In the case of Municipal Systems Act (No. 32 of 2000) Section 78 transfers of water treatment works from DWAF to WSAs, careful change management is required to ensure smooth transition and continuity of the water service.



3. A DRINKING WATER QUALITY FRAMEWORK FOR SOUTH AFRICA

3.1 APPROACH

The National Water Act (No. 36 of 1998) and the National Water Resource Strategy (2004) have incorporated a holistic, integrated perspective of water quality management. Initial efforts in Drinking Water Quality Management in South Africa, however, have focused on the monitoring of drinking water quality to manage drinking water quality and ensure a safe drinking water supply. There is increasing international recognition that monitoring of drinking water for compliance with numerical health limits is not sufficient to guarantee the quality and safety of our water supplies (NHMRC/ARMCANZ Co-ordinating Group, 2001, World Health Organisation, 2004).

We therefore need to challenge the assumption that intensifying compliance monitoring or lowering compliance limits are effective public health protection approaches. While monitoring of drinking water is always important, attention also needs to focus on reducing the likelihood of contaminants entering raw water supplies in the first place. By the time that water quality monitoring indicates that there are health-related contaminants present, a water treatment process failure has occurred and many people may already have been exposed. Drinking Water Quality Managers thus need a proactive system to prevent drinking water quality failures from occurring and resulting in release of contaminated water into the drinking water distribution system.

A significant limitation of an approach that focuses on compliance monitoring only is thus that it promotes reactive management, rather than proactive preventative management, as corrective actions are initiated only after drinking water quality monitoring indicates that guideline values have been exceeded. Other limitations of a compliance monitoring approach to protecting public health include that:

- ❖ It is neither technically nor economically feasible to monitor every possible chemical, physical and microbiological parameter. Furthermore, indicator organisms such as *E. coli* do not always correlate well with risks from viruses and protozoa;
- ❖ Contamination can occur between sampling events and be missed by the monitoring programme;
- ❖ There are limitations in current knowledge of the relationship between numerical guideline values and public health outcomes.

In recognition of the limitations of a purely compliance monitoring approach, a Drinking Water Quality Framework for South Africa is based on a preventative risk management approach, which is comprehensive from catchment to consumer. This approach promotes an understanding of the entire water supply system, the events that can compromise drinking water quality and the operational control necessary for optimising drinking water quality and protecting public health.

In recognition of the challenges facing Water Services Authorities in South Africa, a continual improvement approach is also advocated, with emphasis on fulfillment of minimum legislated requirements and achievement of interim goals and milestones as set by the Water Services Authority to improve drinking water quality.



3.1.1 Key Elements of a South African Drinking Water Quality Framework

A preventative Drinking Water Quality Framework for South Africa addresses four key areas (which are described in more detail in the following section):

- ❖ **Commitment to Drinking Water Quality Management and Multi-Stakeholder Involvement** – Successful implementation requires the support and commitment of all water sector stakeholders. Key stakeholders are required to be identified and appropriate mechanisms for their commitment and involvement must be developed.
- ❖ **System Analysis and Management** – Effective management requires an understanding of the entire water supply system (from the catchment and its source water, through to the consumer, and back into the water system), an assessment of the hazards and events that can compromise drinking water quality, and the implementation of preventative measures and operational controls necessary for assuring safe and reliable drinking water.
- ❖ **Supporting Programmes** – This includes basic elements of good practice to ensure that the system has the capacity to operate and adapt to meet challenges. This includes training of employees within the water sector, community involvement, research and development, validation of process efficacy and documentation as well as effective reporting systems.
- ❖ **Review & Audit** – This includes ongoing evaluation of water quality data and audit processes and their review to ensure that the management system is operating efficiently and satisfactorily and to provide a basis for continual improvement.

(NHMRC/ARMCANZ Co-ordinating Group, 2001)

3.2 COMMITMENT TO DRINKING WATER QUALITY MANAGEMENT

Effective Drinking Water Quality Management requires an integrated approach with collaboration and commitment from all relevant stakeholders. This commitment should be based on an awareness and understanding of the importance of Drinking Water Quality Management and how associated decisions and actions affect public health.

DWAF, as the lead institution for the regulation of drinking water quality in South Africa, is required to provide sector leadership and interact with all key stakeholders to ensure the development and application of appropriate mechanisms for effective delivery of safe drinking water. Sector collaboration, *via* Provincial Task Teams and Fora with appropriate stakeholder representation, will enable effective Drinking Water Quality Management by ensuring clear definition and documentation of roles and responsibilities of the different spheres of government and other stakeholders.

3.3 SYSTEM ANALYSIS AND MANAGEMENT

3.3.1 Assessment of the Drinking Water Supply System

Effective Drinking Water Quality Management requires a clear understanding of the entire drinking water supply system, the hazards and events that can compromise drinking water quality, and the corrective and preventative measures and operational controls necessary for assuring a safe and reliable drinking water supply.



The importance of 'knowing your system', that is, understanding the characteristics of the drinking water system, what hazards may arise, how these hazards create risks, and the processes and practices that affect drinking water quality, cannot be over-emphasised (NHMRC/ARMCANZ Co-ordinating Group, 2001).

In this context, the drinking water supply system is defined as encompassing everything from the point of abstraction of water to the consumer and can include:

- ❖ catchments including groundwater systems;
- ❖ riverine source waters;
- ❖ storage dams and abstractions;
- ❖ drinking water treatment systems;
- ❖ treated water reservoirs and distribution systems, and
- ❖ point-of-use consumers.

Water quality may be affected at any of these points, however, as they are all interrelated, holistic management is essential. Assessment of a drinking water system involves a systematic approach for evaluating a drinking water supplier's current situation with respect to producing reliable and safe drinking water. This requires a Water Supply System Analysis, including a review of existing drinking water quality data, as well as Hazard Identification and Risk Assessment.

Water Supply System Analysis

Effective system management including interpretation of monitoring results involves a good understanding of the water supply system from catchment to consumer. DWAF (and future Catchment Management Agencies), as the custodian of the water resource, is responsible for regular catchment monitoring. In this regard, DWAF has implemented National Water Quality Monitoring Programmes, including the National Chemical and Salinity Monitoring Programme, the National Eutrophication Monitoring Programme and the National Microbial Monitoring Programme. Data from these National Monitoring Programmes are available to all stakeholders.

An analysis should be performed to appropriately characterise each element of the water supply system with respect to drinking water quality and the factors that affect it. This characterisation promotes understanding of the water supply system, and assists with identification of hazards and assessment of risks to water quality.

The system analysis should be conducted in a collaborative manner and include all relevant stakeholders. The analysis should be documented in the form of a flow diagram of the entire drinking water system from catchment to consumer. The purpose of this step is to develop a broad overview and understanding of the supply system.

A review of historical water quality data for the entire drinking water supply system will assist in understanding source water characteristics and system performance both over time and following specific events (for example heavy rainfall). This can aid the identification of hazards and the aspects of the drinking water system which may require improvement. All water quality data should be assessed, including data from routine and investigative monitoring. Where available, data should be assessed from monitoring of source waters, the operation of treatment processes and the quality of final water supplied to consumers.

If no historical water quality data exists, it is recommended that a screening process is undertaken where samples are collected and analysed for a wide variety of water quality constituents. This screening process can be used to group constituents of concern as opposed to those which pose no risk and thus require monitoring at lower frequencies.



Water quality constituents that can provide useful information include:

- ❖ chemical quality, including
 - total organic carbon;
 - pH;
 - disinfectant residuals;
 - disinfection by-products.
- ❖ algal counts
- ❖ microbiological quality, including
 - Total coliforms;
 - *E. coli*.
- ❖ physical quality, including
 - turbidity;
 - colour;
 - taste & odour.

Hazard Identification and Risk Assessment

The most effective means of consistently ensuring the safety of a drinking water supply is through the adoption of a comprehensive risk-based approach enabling the identification of hazards and an assessment of their contribution to water quality risks. All hazards from catchment to consumer (and beyond the tap) need to be considered; some communities in South Africa rely on a tap located a distance away from the household. Safe collection, transportation and storage of water in household containers thus become important.

Hazards and Risks:

- ❖ A hazard is an agent with the potential for causing harm (for example *Cryptosporidium* is a water quality hazard, a potential danger to public health);
- ❖ Risk is the likelihood of identified hazards causing harm, including the magnitude of that harm and its consequences (for example the likelihood that *Cryptosporidium* cysts will breach the water management system barriers with sufficient numbers to cause illness in consumers).

(NHMRC/ARMCANZ Co-ordinating Group, 2001)

A structured approach to identify areas of greatest risk is important to ensure that significant issues are not overlooked. Steps involved in the process should include:

Hazard Identification

- ❖ Identify and document all potential hazards from catchment to consumer.
- ❖ Identify and document hazardous events, causes and scenarios that might affect the drinking water quality (what can happen and how).

Risk Assessment

- ❖ Estimate the level of risk for each hazard/scenario (a function of both likelihood and severity of the consequences).
- ❖ Establish and document priorities for risk management action based on assessment of risk.



All hazards are required to be identified and the level of risk estimated



3.3.2 Preventative Strategies for Drinking Water Quality Management

Prevention is an essential feature of effective Drinking Water Quality Management. When a situation that could give rise to a significant hazard has been identified, preventative strategies can be identified to prevent or control the hazard, thereby minimising its risk.

Preventative strategies are those actions and activities that are required to eliminate hazards or reduce the likelihood or level of their impact to acceptable levels. Preventative strategies should encompass catchment to consumer protection and should be based on validated science and best management practices. Many preventative measures cover a broad spectrum and may control more than one hazard.

Multiple Protection Barriers

Securing the microbiological safety of drinking water supplies is based on the use of multiple barriers, from catchment to consumer, to prevent the contamination of drinking water or to reduce contamination to levels not injurious to health. Safety is increased if multiple barriers are in place, including protection of water resources, proper selection and operation of a series of treatment steps and management of distribution systems to maintain and protect treated water quality.

Application of multiple barriers to prevent contaminants from entering the water supply system and/or to control transmission through the system is thus recognised as a critical and fundamental principle of effective Drinking Water Quality Management and for ensuring the supply of safe drinking water. The strength of the multiple barrier approach is that a failure of one barrier may be compensated for by effective operation of the remaining barriers, thus minimising the likelihood of contaminants passing through the entire treatment system and being present in sufficient amounts to cause harm to consumers.

A wide-ranging programme of protection, treatment and monitoring with barriers to the entry and transmission of contaminants is required to ensure the safety of a water supply.

Traditional barriers include:

- ❖ catchment management and source water protection;
- ❖ abstraction management;
- ❖ coagulation, flocculation, sedimentation and filtration;
- ❖ disinfection ensuring an adequate disinfectant residual, and
- ❖ protection and maintenance of the distribution system.

Water quality may be affected at any of these points but since they are all interrelated, integrated management is required. The security provided by the multiple barrier approach relies on each individual barrier being maintained at all times with any failures or faults being identified and rectified as soon as possible.



3.3.3 Operational Procedures and Process Control

The proper maintenance and operation of water supply, treatment and distribution systems are essential parts of any effort to ensure the production and delivery of the highest quality drinking water possible. Operational procedures vary between treatment plants, but operational-related monitoring requirements should be in place and clear:

- ❖ plants should be supervised by trained and certified operators;
- ❖ operator training programmes should be available;
- ❖ facilities should be inspected on a regular basis; and
- ❖ administrative support should be available.



Documented operational procedures are essential for effective Drinking Water Quality Management

To consistently achieve a high quality water supply, it is essential to have effective control over the processes and activities that govern drinking water quality and safety.

Operational monitoring

Water quality data from operational monitoring can be used as a trigger for immediate short-term corrective action to operational procedures, thereby improving drinking water quality. A key element is the identification of parameters that control performance so that their status can be used to predict ultimate output quality and provide adequate lead-time for corrective action. Wherever possible, online and continuous monitoring of key parameters should be undertaken (for example chlorine residual, pH and turbidity).

Operational Monitoring: It is recommended that the following water quality constituents be analysed to optimise treatment processes for drinking water quality:

- ❖ **Microbiological**
 - Total coliforms (evaluation of water treatment processes, microbial growth in the distribution system or post-treatment contamination of drinking water);
 - Faecal coliforms (water is contaminated with faecal waste of human or animal origin) or *E. coli* (rarely found outside intestines, except where faecal pollution has occurred);
- ❖ **Physico-Chemical**
 - pH (taste, corrosivity)
 - Turbidity (turbidity indicates poor water treatment, cross-contamination and/or corrosion, and is problematic in that it prevents effective disinfection).
 - Water treatment residual chemicals and disinfectants (for example, aluminium from aluminium sulphate dosing, free chlorine residual from disinfection *via* chlorination).



Operational Preventative and Corrective Action

Advance planning should be undertaken to establish appropriate procedures for immediate preventative and corrective action required to re-establish process control when operational monitoring indicates that target limits have not been met. Adoption of internal operating guidelines that are more stringent than the South African National Standard (SANS) Drinking Water Specification limits acceptable for lifetime consumption, and acting when these guidelines have been exceeded, will reduce the chances of exceeding SANS 241 limits in the final waters. Operating procedures should be documented and include instructions on required adjustments and process control changes and should clearly define responsibilities and authorities including communication and notification requirements.



Procedures should include the range of actions to be taken in response to exceedance of internal target limits. Where appropriate, these actions may include resampling, additional monitoring and/or confirming the results by additional operational monitoring. When preventative or corrective action is taken to re-establish process control, it should be verified to ensure its effectiveness.

Examples of preventative and corrective actions for which operational procedures should be documented include:

- ❖ selection of alternate raw water source if available;
- ❖ altering plant flow rate (for example, reducing the loading on the works);
- ❖ jar testing for coagulant control and optimisation;
- ❖ altering mixing intensity;
- ❖ changing treatment chemicals;
- ❖ adjusting pH;
- ❖ varying chemical feed rates and feed points;
- ❖ adjusting filtration loading rate and/or operation;
- ❖ adjusting the frequency and manner of backwashing cycles of the filters;
- ❖ increasing disinfectant dose;
- ❖ secondary/booster disinfection, and
- ❖ mains flushing, cleaning and localised disinfection.

Where possible, the underlying cause of a problem should be identified and measures implemented to prevent future occurrences. An analysis of the causes may identify some solutions such as modifying an operating procedure, process control adjustments and operator training. Finally, details of the incident should be recorded and reported.

3.3.4 Verification of Drinking Water Quality

Verification of drinking water quality provides an assessment of the overall performance or compliance of the system and the ultimate quality of drinking water being supplied to consumers. This incorporates monitoring drinking water quality as well as assessment of consumer satisfaction.

Compliance Monitoring

Drinking water quality compliance monitoring is a wide-ranging assessment of the quality of water after treatment before it leaves the treatment plant, in the distribution system and as supplied to the consumer. It includes the regular sampling and testing performed for assessing conformance with guideline values and, where applicable, compliance with regulatory requirements.

Monitoring of drinking water quality should be regarded as the final check by the Water Services Authority that, overall, the barriers and preventative measures implemented to protect public health are working effectively. Although demonstrating compliance with regulatory limits is necessary as verification, it should be recognised that monitoring of drinking water quality is only one aspect of an overall preventative strategy to assure a safe and reliable drinking water supply. Monitoring for drinking water quality should never be used as a replacement for any of the barriers or as a reason for removing them.



Compliance Monitoring is the final check that the barriers and preventative measures implemented to protect public health are working effectively



The **SANS 241 Drinking Water Specification** is the definitive reference on acceptable limits for drinking water quality parameters in South Africa and provides guideline levels for a range of water quality characteristics. The SANS 241 Drinking Water Specification effectively summarises the suitability of water for drinking water purposes by specifying two classes of water: Class I (Acceptable for lifetime consumption) and Class II (Maximum Allowable). In essence, drinking water quality should pose no health risk, and should satisfy SANS 241 limits for specified time frames.

Drinking water quality compliance monitoring differs from operational monitoring not only in purpose but also in terms of the water quality characteristics to be measured, sampling locations and frequency of sampling. As it is neither physically nor economically feasible to test for all drinking water quality constituents at the same frequency, monitoring effort and resources should be planned and directed at key water quality constituents.

Key constituents for drinking water quality monitoring related to health include:

- ❖ Microbiological indicator organisms (total coliforms and *E. coli*);
- ❖ Concentrations of chemicals used in treatment processes, disinfectant residuals, and any disinfection by-products;
- ❖ Any health-related constituent that can be reasonably expected to exceed the guideline value, even if occasionally; and
- ❖ Any other potential contaminants identified in System Analysis and Hazard Identification.

It is recommended that all health-related determinands specified in the SANS 241 Drinking Water Specification should be monitored at least after commissioning a water treatment works, or preferably at an annual frequency. It is recommended (but not essential) that constituents monitored for drinking water quality compliance purposes are analysed in a SANAS-accredited laboratory.

The recommended minimum sampling frequencies specified in the SANS 241 Drinking Water Specification should be adhered to, as these frequencies are based on population served and volume of water treated (see Table A.1 in Annexure 2). However, constituents which have results significantly below the SANS 241 Drinking Water Specification limits (or detection limits) can be monitored at less frequent intervals to minimise monitoring costs.

Sampling frequencies should also consider the risk of contamination. Furthermore, the frequency of testing for individual constituents will depend on their variability, and whether they are of aesthetic or health significance. Sampling should be frequent enough to enable the monitoring to provide meaningful information and statistical validity. Sampling and analysis is required more frequently for microbiological constituents, and less often for organic and inorganic compounds. This is because even brief episodes of microbial contamination can cause immediate infection and illness in consumers whereas guideline values for most chemical parameters are based on impacts of chronic exposure. In the absence of a specific event (such as chemical overdosing at a treatment plant), episodes of chemical contamination that would constitute an acute health concern are rare.

Location of sampling depends on the water quality constituent being examined as well as the characteristics of the distribution system being managed. For constituents where the concentration does not change greatly within the distribution system, sampling the water at the treatment plant may be sufficient. However, for characteristics that vary in concentration during distribution, sampling should be undertaken throughout the distribution system including the point of supply to the consumer. It should be noted that the behaviour of some constituents (such as disinfection by-products, chlorine residual, turbidity and microbiological quality) during distribution may vary from one system to another.



The decision of whether to disinfect the sample tap before sampling is dependant on the objective of the monitoring:

- ❖ If the objective of monitoring is to assess the quality of the water supplied by the WSA, the tap should be flamed prior to sampling;
- ❖ If the objective of monitoring is to assess the fitness of the water for consumption and the impact on public health, the tap (or the community container) should not be disinfected before sampling.

The Water Services Authority's Drinking Water Quality Monitoring Programme as well as the drinking water quality monitoring data should be captured onto a Drinking Water Quality Management database and made available *via* a national internet based system to facilitate the provision of information on the status of drinking water quality management to a wide range of stakeholders.

Additional information on drinking water quality sampling, analysis, assessment, treatment and management can be found in the Department of Water Affairs and Forestry, Department of Health and Water Research Commission guides on the **Quality of Domestic Water Supplies**:

- ❖ Volume I: Assessment Guide;
- ❖ Volume II: Sampling Guide;
- ❖ Volume III: Analysis Guide;
- ❖ Volume IV: Treatment Guide, and
- ❖ Volume V: Management Guide.

(Available from <http://www.dwaf.gov.za/iwqs/report.htm>)

Consumer Satisfaction

Monitoring of consumer comments and complaints can provide valuable information on potential problems that may have gone unidentified in performance monitoring of the water supply system. Consumer satisfaction of drinking water quality is largely based on a subjective judgement that the aesthetic quality of tap water is acceptable which usually means that it is colourless and free from suspended solids and unpleasant taste or odour. Such aesthetic problems with water may be interpreted by some consumers as being associated with health risks. A consumer complaint and response programme which details mechanisms for logging, recording and evaluating consumer complaints should be established and documented for prompt response to any potential problems in the water supply system.

Water Services Authorities are required to have a Consumer Service (Regulation 16 of Section 9 of the Water Services Act (No. 108 of 1997)) which could serve as a conduit for consumers to report non-compliance to their Water Services Authority.

Many rural schemes are reliant on Community Based Organisations (CBOs) conducting surveys with consumers to determine drinking water quality (based on aesthetic and health-related complaints). These qualitative data should also be assessed as collection of water samples from these villages on a monthly basis may be impractical and costly. In these cases, the WSA is reliant on feedback from CBOs who have interviewed consumers.

3.3.5 Incident and Emergency Response

One of the major goals of the South African Government is to ensure access to safe and reliable water services to all the communities. Notwithstanding the best possible raw water sources, adequate treatment infrastructure and optimal treatment processes, unexpected incidents can disrupt water supplies. Natural disasters such as floods, and man-made incidents, for example catchment chemical spills and bacteriological contamination, can



significantly disrupt and impact on the quality of water services thus posing a significant health risk to consumers.

The Water Services Act (No. 108 of 1997) Section 5(4), states that in emergency situations, a Water Service Authority must take reasonable steps to provide basic water supply to any person within its area of jurisdiction and must do so at the cost of the authority. This can be achieved by having emergency protocols and communication plans in place.

Emergency protocols and communication plans ensure that during drinking water failures:

- ❖ Key stakeholders are kept fully informed;
- ❖ Roles and responsibilities of individuals and organisations are clearly outlined to avoid miscommunication and duplication of effort;
- ❖ Timeous interventions are taken to rectify the situation; and
- ❖ Affected communities are properly informed and have alternative safe drinking water for the duration of the problem.

Emergency protocols and communication planning are therefore critical in minimising public health risks associated with drinking water failure.

Incident and Emergency Planning

Every system must have a set of procedures to follow in the event of incidents leading to emergencies. These procedures should be in place well in advance of any event. Plans should cover any number of incidents that could potentially affect drinking water quality, such as loss of source water, major main breaks, vandalism, power or process failures and deliberate chemical or biological contamination of the distribution system or reservoirs. Emergency plans should include clear procedures for the remediation of the situation and communication with appropriate authorities. A coordinated emergency response strategy should be developed to identify clear roles and interrelated response mechanisms.



Emergency water supplies may need to be supplied during a drinking water failure

Actions and protocols should be developed in consultation with relevant regulatory authorities and other key agencies. It is vital that protocols are developed prior to the occurrence of any incident or emergency to enable efficient, effective and rapid response that will minimise the impacts on the community. Establishing procedures when emergencies occur is a recipe for disaster and the potential loss of public confidence. Incident and emergency response protocols must be communicated to all relevant personnel and copies of documented procedures must be available.

Incident and Emergency Response Protocols

Incident and emergency response protocols should be regarded as a priority with necessary resources committed to developing emergency response plans. The development of an appropriate plan involves a review of the hazards and events that can lead to emergency situations, including:

- ❖ non-compliance with guideline values and other requirements;
- ❖ accidents which increase levels of contaminants (for example, spills in catchment, incorrect dosing of chemicals);
- ❖ leaks in the distribution system where negative pressures are experienced during low flow periods;
- ❖ equipment breakdown and mechanical failure;
- ❖ prolonged power failures;



- ❖ extreme weather events (for example flooding), and
- ❖ human actions (for example strikes resulting in lack of control of the treatment plant).

Plans should involve consultation with relevant regulatory authorities and key agencies and should be consistent with existing government emergency response arrangements. Key areas to be addressed in incident and emergency response plans include clearly specified:

- ❖ response actions including increased monitoring;
- ❖ responsibilities and authorities internal and external to the organisation;
- ❖ plans for emergency water supplies;
- ❖ communication protocols and strategies including notification procedures (internal, regulatory body, media and public); and
- ❖ mechanisms for increased health surveillance.

Training in emergency response is important to ensure that employees have the skills and knowledge to effectively manage any potential incidents and/or emergencies. Incident and emergency response plans, particularly communication protocols, should be regularly reviewed and practised to improve preparedness. Change control should be diligently exercised when personnel join or leave each organisation.

Following any incident/emergency situation, an investigation of the incident and/or emergency should be undertaken and a debriefing with all involved staff should be conducted to discuss performance and address any issues or concerns. Appropriate documentation and reporting of the incident/emergency should also be established. The organisation should learn as much as possible from the incident to improve preparedness and planning for future incidents. Review of the incident may indicate necessary amendments to existing protocols.

Communication with the community is essential for restoring consumer confidence and drinking water supplier credibility after an incident and/or emergency situation. Notifications advising the end of an incident/emergency and information regarding the cause of the incident and the actions taken to minimise future occurrences are necessary activities for allaying community concerns.

3.3.5.1 Proposed Drinking Water Failure Response Model

Definition of a Drinking Water Quality Failure

The Water Services Act (No. 108 of 1997) states that drinking water quality should comply with prescribed National Drinking Water Standards (SANS 241 Drinking Water Specification). The ideal situation is where drinking water quality satisfies the SANS 241 Class I limits, suitable for lifetime consumptions. Where a water fails Class I limits, but is within the Class II limits, efforts are required to ensure that water quality is improved to within Class I limits. Importantly, when a constituent does not comply with SANS 241 Class II limits, this is regarded as a failure and would pose a threat to consumers. Clear Maximum Allowable limits (Class II limits) are provided in Table 2 of SANS 241 for physical, organoleptic and chemical constituents.

Microbiological constituents (such as total coliforms, *E. coli*, and the protozoan parasites *Cryptosporidium* and *Giardia*) can cause the water to fail the Drinking Water Specification if they exceed the allowable compliance contribution specified in Table 1 of SANS 241. Furthermore, where a single microbiological test result exceeds the value given in SANS 241 column 5 of Table 1 (for example, *E. coli* > 1 count per 100 mL, or faecal coliform > 10 counts per 100 mL), and is confirmed as such by a further test, this is regarded as a drinking water quality failure and the required remedial actions and drinking water quality failure response shall follow.

Tables 1 and 2 of the SANS 241: 2005 Drinking Water Specification are shown in Annexure 2 for reference.

Drinking water quality failures can be considered acute or chronic, depending on associated risks and/or concentrations of the constituents, and therefore require different management approaches.



Acute Drinking Water Quality Failure Response

Acute water quality failures are of a short duration, can do harm even with short exposure, and usually result from treatment process inefficiency, water works breakdown or outbreak of bacteriological and protozoan parasite contamination. Acute failures require immediate interventions and if properly managed, can avoid a significant threat to consumers. Examples of acute failures are outbreaks of *Cryptosporidium* and *Giardia*, and equipment breakdown resulting in overdosing treatment chemicals.

Regulation 5 of Section 9 of the Water Services Act (No. 108 of 1997), the Compulsory National Standards for the Quality of Potable Water, states:

Should the comparison of the results as contemplated in sub regulation (3) indicate that the water poses a health risk, the water services institution must inform the Director-General of the Department of Water Affairs and Forestry and the head of the Provincial Department of Health, and it must take steps to inform its consumers-

- (a) that the quality of the water that it supplies poses a health risk;*
- (b) of the reasons for the health risk;*
- (c) of any precautions to be taken by the consumers; and*
- (d) of the time frame, if any, within which it may be expected that water of a safe quality will be provided.*

Three Alert Levels are proposed to respond to acute drinking water quality failures :

- ❖ Alert Level I (no significant risk to health): Routine problems including minor disruptions to the water system and single sample non-compliances (Internal Water Services Authority response only)
- ❖ Alert Level II (potential minor risk to health): Minor emergencies, requiring additional sampling, process optimisation and reporting/communication of the problem (Internal Water Services Authority response only).
- ❖ Alert Level III (potential major risk to health): Major emergencies requiring significant interventions to minimise public health risk (Engagement of an designated Emergency Management Team).

The recommended Drinking Water Failure response actions for Acute Failures are depicted in Figures 1a and b.



Figure 1a: Acute Drinking Water Quality Failure Model - Response actions

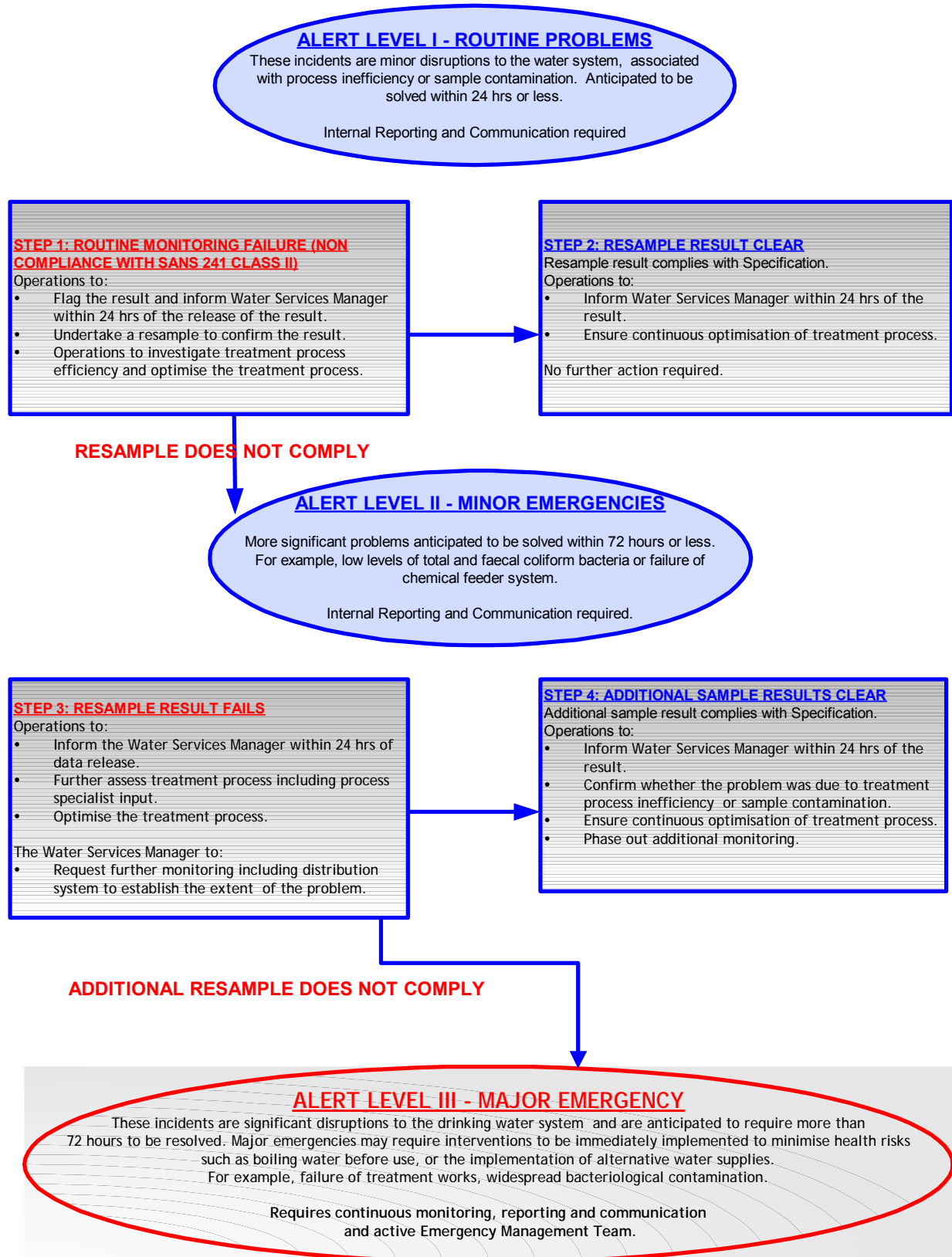
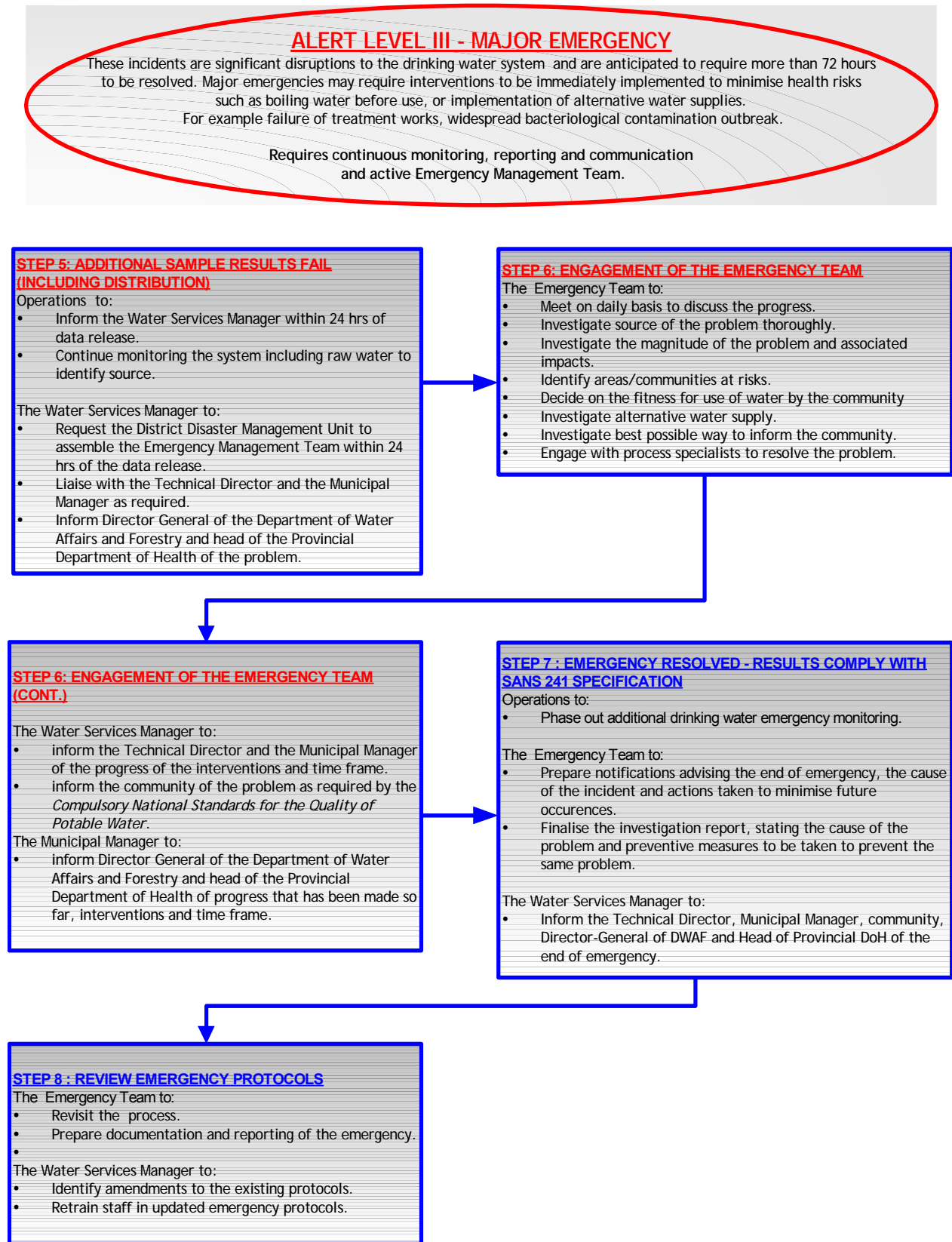




Figure 1b: Acute Drinking Water Quality Failure Model - Response actions (continued)





Emergency Management Team

As part of emergency preparedness planning, key role-players in the water sector should be identified and form an Emergency Management team. The Emergency Management team will ensure better management of the emergency situation by involving a number of role players with different expertise to manage the situation. The team plans for coordination of activities, specific roles for stakeholders and reporting protocol, it also manages internal and external communications and information. Depending on the scale of the drinking water quality failure, it is proposed that the District or Provincial Disaster Management Unit coordinate and manage the compilation of the Emergency Management Team.

The Emergency Management Team should include a range of key stakeholders involved in a drinking water failure crisis, including:

- ❖ District or Provincial Disaster Management Unit;
- ❖ WSA Water Services Manager;
- ❖ WSA Water Works Operations;
- ❖ WSA Consumer Services unit;
- ❖ Provincial Department of Local Government;
- ❖ DWAF Regional Office;
- ❖ Department of Health and the District Municipality Environmental Health Practitioners;
- ❖ Relevant Non-Governmental Organisations and Community-Based Organisations;
- ❖ Community leaders, and
- ❖ Other experts in public health or water treatment, as required.

The Emergency Management team members' database with the names and contact details of the members should be readily available and the relevant Water Services Authority must ensure that the database is updated regularly (for example 6-monthly) to ensure that it is accurate.

Chronic Drinking Water Quality Failure Response

Chronic drinking water quality failures have cumulative effects, and usually cause harm due to prolonged exposure to a certain constituent. Chronic failures are a result of poor source water quality, inadequate treatment processes and poor distribution system infrastructure. Examples of chronic failures are continuous low-level failure of microbiological constituents, or total trihalomethane concentrations exceeding SANS 241 Class II limits which is related to high organic loadings in the raw water source.

Chronic raw water quality responses require a more co-operative governance approach, with a range of key stakeholders required for interventions. This could involve stakeholders such as Department of Water Affairs and Forestry, Catchment Management Agencies and Fora, Department of Environmental Affairs, industrial bodies and Local Government.

Response to Chronic Water Quality Failure

- ❖ A detailed investigation should be carried out to identify source of the problem, following the catchment to consumer approach.
- ❖ The stakeholders should meet to further discuss possible interventions. Several issues may be identified and prioritised, including upgrade of infrastructure, sourcing of funds to address water quality problems and monitoring of industrial effluent or diffuse source discharges.



3.3.6 Drinking Water Quality Management in Communities not yet served with Potable Water

In South Africa, approximately 5 million (11 %) of population do not have access to safe drinking water, the greatest proportion of which live in rural areas (DWAF, DPLG and NT, 2003). Whilst the government is making progress towards reducing water backlogs in the country, in the interim, the unserved population rely on rivers, streams, dams, springs, wetlands, boreholes and other raw water sources for drinking water and other domestic purposes. In most cases, the quality of these water resources is unsatisfactory or has not yet been determined.



Approximately 5 million people living in South Africa do not have access to safe drinking water

Preventative Drinking Water Quality Management for the unserved communities focuses on protection of the catchment and raw water resource used by unserved communities, and measures that can be implemented to reduce incidents associated with unsafe water consumption in unserved communities.

Stakeholder Commitment, Roles and Responsibilities

In the case of the unserved communities, stakeholder commitment to the protection of public health becomes even more important. Key stakeholders involved in Drinking Water Quality Management for unserved communities, and their roles, responsibilities and accountabilities include:

Water Services Authorities: Local government has a responsibility to provide municipal services to all communities within its area of jurisdiction. The responsibility for ensuring safe drinking water thus lies with local government, supported by other stakeholders. Roles and responsibilities of Water Services Authorities in terms of communities not yet served with potable water include:

- ❖ Identification of unserved communities and their existing water sources;
- ❖ Provision of alternative water sources where needed;
- ❖ Water quality monitoring (as stipulated in National Health Act, No. 61 of 2003), and
- ❖ Liaison with affected communities to propose possible interventions to improve water quality.

Department of Health: The Department of Health has the overall responsibility of '*protecting, respecting, promoting and fulfilling the rights of people of South Africa to an environment that is not harmful to their health or well being*' (National Health Act, No. 61 of 2003). The Department of Health is responsible for coordinating all health related services in conjunction with the municipality; these may include health and hygiene education and awareness and provision of disinfectants where needed.

Department of Education: Department of Education has a role to play in ensuring that risks associated with poor water quality are reduced by providing or promoting environmental/health and hygiene education at schools. In this way, school children can influence other community members regarding best possible hygiene practices and the importance of water conservation and minimising pollution of water resources.

Department of Water Affairs and Forestry: DWAF has the responsibility of ensuring that water resources are protected, used, developed, conserved and managed in an equitable and sustainable manner. Many of these responsibilities will eventually be undertaken by the proposed Catchment Management Agencies (CMAs), which will work closely with communities to ensure that water resources are protected, conserved and managed properly. Issues such as pollution and water scarcity should be tabled in such foras.



Water Resource Assessments

Most communities rely on water sources for which the quality of that source is unknown. Determining the quality and quantity of water sources is an underlying requirement in identifying and addressing health risks resulting from consuming water from poor water quality sources. This can be achieved by implementing monitoring programmes and assessing water quality of water sources. Information gathered will be used to institute interventions to improve the situation including awareness education, boiling of water, chlorination, and alternative water supplies such as mobile water tanks.

DWAF (and future Catchment Management Agencies), as the custodian of the water resource, is responsible for regular catchment monitoring. In this regard, DWAF has implemented National Water Quality Monitoring Programmes, including the National Microbial Monitoring Programme (NMMP). The goal of the National Microbial Monitoring Programme is to provide the information needed to assess and manage the potential health risks to water users related to the faecal pollution of South Africa's water resources. The NMMP focuses on potential high health risk areas, as determined according to land uses which have an associated high risk of faecal pollution of water resources, and the number of people that would be impacted by exposure to significant potential health risk from poor microbiological water quality as a consequence of their water use. Information generated by the NMMP is communicated to interested and affected stakeholders, including the Department of Health. The NMMP is thus one of the programmes that can be used to identify microbial status of raw water sources and assess the fitness for use of that water resource. Other National DWAF Monitoring Programmes can also assist with identification of the status of the raw water resource, including the National Chemical and Salinity Monitoring Programme, the National Eutrophication Monitoring Programme and the River Health Programme.



The NMMP monitors the microbial status of water resources in high health risk areas

Hazard Identification and Risk Assessment

A critical element of preventative, proactive Drinking Water Quality Management for unserved communities is the adoption of a risk-based approach enabling the identification of hazards and an assessment of their contribution to water quality risks.

Community Health and Hygiene Training and Awareness

Health and hygiene education has been singled out as the most effective mechanism in preventing water-related illnesses, such that awareness education is an integral component of the current and proposed initiatives aiming at improving lives of served and unserved communities. Health and hygiene education and awareness aims at changing/improving health and hygiene habits thus serving as a barrier to water related diseases. It addresses several issues such as:

- ❖ Safe collection, transportation and storage of water;
- ❖ Eliminating bacteriological contaminants by training on low-technology point of use treatment methods, including boiling, use of household bleach or HTH granules and exposure to sunlight, and
- ❖ Safe disposal of waste and faecal matter to prevent contamination of water resource.



Health and hygiene education is effective in preventing water-related illnesses

Several methods have been introduced to ensure the effectiveness of health and hygiene awareness and education, using a range of participatory methods/tools such as Participatory Hygiene and Sanitation Transformation (PHAST) tools. Health and hygiene education and awareness, undertaken by the Environmental Health Officers of the WSA, should not only target unserved communities, but is also recommended to include



served communities. Research has shown that provision of safe water and sanitation services without health and hygiene education to facilitate the required behavioural changes, is not as effective in reducing diseases and improving the general health of the community.

Drinking Water Quality Failures: Investigation of alternative supplies/methods

In cases of acute or chronic drinking water quality failures, alternative supplies and methods need to be investigated to reduce health risks associated with unsafe water use. There are a number of options that can be explored, including:

- ❖ **Point-of-use treatment methods:** In communities where no clean water sources are available, and contaminated water is routinely consumed, low-technology point of use treatment methods are recommended, including boiling, use of household bleach or HTH granules and exposure to sunlight.
- ❖ **Preferential use of groundwater as a water source:** Where available, groundwater (boreholes/springs) may be used, because when sources are properly protected, bacteriological contamination is minimised. In some provinces, the Department of Health (Environmental Health Section) have been involved in Spring Protection Programmes working closely with the communities. The programme involves identification of springs, assessment of the water quality, and erection of a structure to cover/protect it from being exposed to outside environment thus reducing contamination.
- ❖ **Mobile water supplies:** Where water quality has deteriorated to such an extent that conventional methods such as boiling and adding disinfectants are inadequate, mobile water supplies/tanks should be provided, while interventions are undertaken to improve the situation.

3.4 SUPPORTING PROGRAMMES FOR THE DRINKING WATER QUALITY FRAMEWORK

Many actions are important in ensuring drinking water safety, but do not directly affect drinking water quality. These are termed Supporting Programmes and include basic elements of good practice to ensure that the system is sustainable and has the capacity to operate optimally and adapt to meet challenges.

3.4.1 Stakeholder Awareness and Training

The knowledge, skills, motivation and commitment of staff involved in Drinking Water Quality Management ultimately determine the ability of WSAs or WSPs to successfully operate a water supply system. It is thus important to ensure that the level of awareness, understanding and commitment to optimising and continually improving drinking water quality is developed and maintained.

Water Services Authority Employee Awareness and Involvement

Increasing awareness and understanding of Drinking Water Quality Management are essential elements in empowering and motivating employees to make effective decisions. All employees should be aware of the characteristics of the water supply system, what preventative strategies are in place throughout the system, regulatory and legislative requirements, roles and responsibilities of employees and departments, and how their actions can impact on water quality and public health.

Employee awareness can be delivered and enhanced in various ways including the development of employee education/induction programmes, newsletters, guidelines and manuals, notice boards, seminars, briefings and meetings. Employee participation and involvement in decision making is also an important feature for establishing the commitment necessary for continuous improvement of Drinking Water Quality Management.



Employees should be encouraged to participate in decisions that affect their jobs and areas of responsibility as allowing employees to participate in decision making provides a sense of ownership for decisions made and their implications.

Water Services Authority Employee Training

The training of employees in issues relating to drinking water quality is essential to the provision of a safe and reliable drinking water supply. Water treatment employees must be appropriately skilled and trained in the management and operation of water supply systems as their actions can have a major impact on drinking water quality.



WSA staff are required to be trained on all aspects of drinking water supply systems

Employees should have a sound knowledge base from which to make informed operational decisions. This includes training in the methods and skills required to perform their tasks in an efficient and competent manner as well as the knowledge and understanding of the impact their activities can have on water quality.

Training needs should be identified and it should be ensured that employees performing tasks that could have a significant impact on drinking water quality are competent to perform those tasks. Employees assigned responsibilities for managing drinking water quality should be qualified on the basis of appropriate education, training and experience as required. Accredited training programmes and certification of operators are desirable. Water Services Authorities should utilise the services of the ESETA (Energy Sector Education and Training Authority) to build the capacity of their treatment works operators.

Appropriate training to address specific needs should be developed and implemented, and adequate resources made available to support training. Examples of relevant areas to address include general water quality, and specific training to optimise system performance such as:

- ❖ coagulant control testing;
- ❖ proper filter operation;
- ❖ disinfection system operation;
- ❖ reticulation management;
- ❖ sampling, monitoring and analysis;
- ❖ interpretation and recording of results, and
- ❖ maintenance of equipment.

Employees should also be trained in other aspects of Drinking Water Quality Management including incident and emergency response, documentation, and reporting.

Training should be documented and records of all employees who have participated in training maintained. Mechanisms for evaluating the effectiveness of training should also be established and documented. Training is an ongoing process and employee training requirements should be regularly reviewed. For those activities that have a significant impact on drinking water quality, periodic verification of the competence of operations staff is necessary.

3.4.2 Community Involvement and Awareness

Community consultation, involvement and awareness can have a major impact on public confidence in the water supply and the organisation's reputation. A communication programme including both consultation and



education should be designed to provide active, two-way exchange of information to ensure that the consumers' needs and expectations are understood and are being satisfied.

Community Consultation

Decisions on drinking water quality made by a Water Services Authority, DWAF and DoH must be aligned with the needs and expectations of its consumers. Therefore, involvement and consultation with the community and appropriate industry sectors, should be sought during decision-making processes.

Decisions and agreed levels of service should be based primarily on estimates of risk and cost, together with knowledge of the raw water source (including the degree of catchment management), treatment processes, history of the distribution system, and the drinking quality management programme undertaken over its operation.

Public Awareness and Involvement

Effective communication to increase community awareness and knowledge of drinking water quality issues and the various areas of responsibility is essential. Communication aims to enable informed participation and decision-making by consumers about the drinking water quality service provided by the Water Services Authority.

Management of communication is particularly important in the event of an incident or emergency. Civil society has expectations of government transparency, especially about issues that affect its health.

Involving the public at every stage means:

- ❖ Making monitoring results or summaries available and easily accessible, such as on the Internet or *via* newsletters and public fora;
- ❖ Notifying the public about risks to their health and what the Water Services Authority is doing to address the risks ;
- ❖ Issuing regular reports about drinking water systems, including improvements and areas that need further attention;
- ❖ Educating the public on a number of issues, including: the benefits of disinfection over the risks of microbiological contamination and disease; how drinking water standards are developed and what they mean; and the true cost of providing safe drinking water;
- ❖ Incorporating public consultations into decision-making processes which affect public health, including the development process for new guidelines and regulations, and
- ❖ Education about water resource protection and conservation issues.

3.4.3 Research and Development

A sector commitment to conduct and participate in research and development activities aimed at advancing knowledge of drinking water quality issues is important to ensure continual improvement and to support ongoing capacity to meet drinking water quality requirements. The Water Research Commission is involved in promoting and funding research into Drinking Water Quality Management in South Africa.

Ongoing research at Water Services Authority level is also necessary to increase understanding of the specific characteristics of individual water supply systems. Such research could include, for example, detailed analysis of temporal and spatial variations in source water quality parameters. Research and development activities should also investigate mechanisms to improve/optimize plant performance, evaluation of treatment processes including the validation of critical limits and target criteria, and design of new equipment.

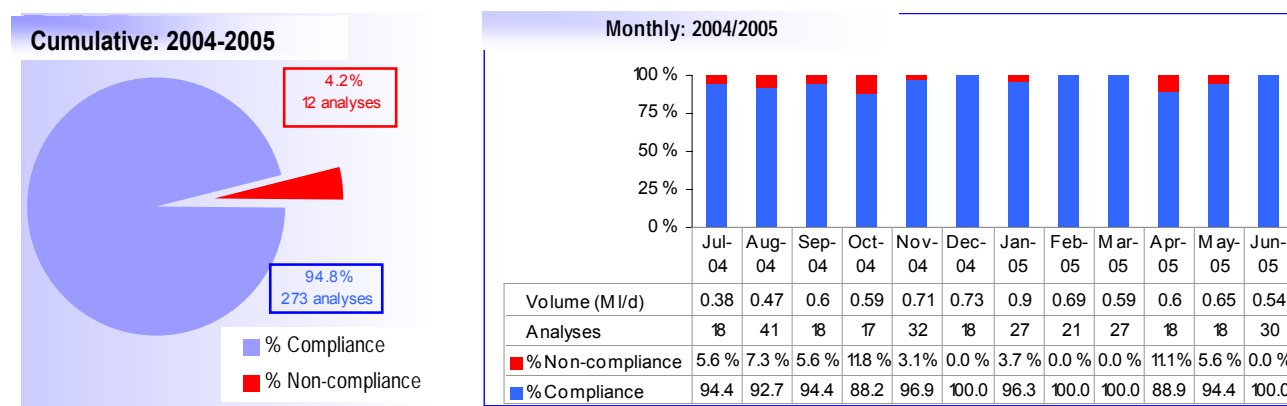


3.4.4 Documentation and Reporting

Appropriate documentation provides the foundation for the establishment and maintenance of an effective Drinking Water Quality Management system. Documentation also provides a basis for effective communication within the organisation as well as with the community and various stakeholders. A system of regular reporting, both internal and external, is important to ensure that the relevant people receive information needed to make informed decisions about the management or regulation of drinking water quality.

Reporting publicly on drinking water quality performance thus ensures a high level of transparency and public accountability. The following Drinking Water Quality Management reports are proposed:

- ❖ *Monthly report (Operational monitoring report)* - This is usually a summary report of the compliance of the drinking water quality during the month. It is useful in assessing the system's performance, treatment process efficiency and infrastructure problems. Monthly reports are also useful for benchmarking purposes, with benchmarking playing an important role in assessing the performance of a water services authority/institution against other institutions, thus promoting learning and exchange of information between the institutions.



Example of monthly Operational monitoring report

- ❖ *Quarterly report (Consultative audit report)* - This report is proposed to be used by Consultative Audit teams to assess compliance of each Water Services Authority with the *Compulsory National Standards for the Quality of Potable Water*. These audits can be used to determine required regulatory intervention, assess progress in achieving drinking water quality compliance, and recommend Municipal Infrastructure Grant (MIG) and Capacity Building Grant (CBG) funding where capacity is lacking.
- ❖ *Annual Report (Stakeholder information report)* - Annual reports should be produced and made available to consumers, regulatory authorities and stakeholders which summarise drinking water quality performance over the preceding year against numerical guideline values and regulatory requirements. The report should include targets for water services quality, performance against targets, interventions undertaken to improve water services during the annual period such as instituting monitoring programmes, upgrading infrastructure and working with DWAF/CMAs to improve raw water quality. Reports should also provide a summary of system failures and the action taken to resolve them. Annual reports also provide a mechanism for feedback and encourage consumers and stakeholders to provide comment. The reports should contain sufficient information in suitable formats to enable individuals or groups to make informed judgements about the quality of their drinking water.



3.4.5 Funding for Drinking Water Quality Management

In acknowledgement of institutional capacity problems hindering WSAs, a number of possible funding mechanisms are available to WSAs for implementation of Drinking Water Quality Management programmes:

Table 1: Funding mechanisms for Drinking Water Quality Management

Funding mechanism	Source of funds	Notes
WSA internal funding	WSA	Funds obtained from within the WSA exchequer either from commercial sources or from within the WSA budget.
Municipal infrastructure grant (MIG)	DPLG	Funding for basic service infrastructure investment. The funding requirement must be contained within the Integrated Development Plan (IDP) and Water Services Development Plan (WSDP) and requires a registration process as well as a feasibility study.
Special municipal infrastructure fund (SMIF)	DPLG	Special funding for innovative infrastructure investment (approximately 3% from MIG budget available). Access to funding is <i>via</i> a business plan.
Masibambane	DWAF	Donor and DWAF funding for both infrastructure development, and capacity and support to WSAs. Requires the compilation of a business plan to access the funding.
Capacity building grant (CBG)	DPLG	Funding of WSA capacity support requirements. Requires the compilation of a business plan to access the funding.
Equitable share	State Treasury	Unconditional grant made to WSA based on number of indigent population, which is used for the provision of services.
Donor funding	Direct from donors	Direct funding from donor countries and organisations for specific programmes.



3.5 REVIEW & AUDIT

3.5.1 Evaluation and Audit

The evaluation and auditing of drinking water quality data and management is required to ensure that preventative strategies are effective and implemented appropriately.

Long-term Evaluation of Water Quality Data

The systematic review of monitoring results over an extended period enables assessment of overall performance against numerical guideline values, regulatory requirements and agreed levels of service, identifies emerging problems and trends, and assists in determining priorities for improving drinking water quality.

Procedures should be established for the collection and evaluation of drinking water quality data and other operational data from catchment to consumer to assess long-term performance and to allow observation and trending of data.

Drinking Water Quality Management Audit

DWAF, as the sector regulator, is the recommended authority for undertaking Drinking Water Quality Management System Regulatory Audits where a wide-ranging assessment of performance (including compliance to national norms and standards) is undertaken in a specific WSA at a specified frequency.

Types of audits may include for example:

- ❖ Management system audits;
- ❖ Operational audits;
- ❖ Drinking water quality compliance audits;
- ❖ Effectiveness of incident and emergency response or other specific aspects of Drinking Water Quality Management, and
- ❖ Customer Services audits.

The Drinking Water Quality Management System Regulatory Audits may be scheduled or unscheduled.

Audit results should be appropriately documented and communicated to Water Services Authority management and personnel responsible for the department or function being audited.

A set of agreed Drinking Water Quality Management key performance indicators, measures and targets should be developed to assess WSA performance when implementing the Drinking Water Quality Management System Regulatory Audit. These key performance indicators, measures and targets (benchmarks) will form a subset of the Regulatory key performance indicators, measures and benchmarks.



4. DRINKING WATER QUALITY REGULATION STRATEGIES

The current situation in South Africa is that many Water Services Authorities do not undertake their mandated responsibilities for drinking water quality monitoring, management and communication, and most Water Services Authorities fall far short of the vision of 'Effective Drinking Water Quality Management Ensuring Safe Drinking Water'. Due to the need for immediate action, the perceived lack of resources and capacity in the WSAs to conduct the required drinking water quality management (including monitoring), and the perceived lack of understanding of the WSAs regarding governance requirements, responsibilities and accountabilities, both short- and medium-term intervention strategies followed by a longer term Drinking Water Quality Management Strategy are necessary.

4.1 KEY PRINCIPLES FOR IMPLEMENTATION

In recognition of:

- ❖ Significant progress that has been made in providing basic services since 1994, including drinking water and sanitation;
- ❖ Service delivery backlogs existing in key areas including the provision of safe drinking water;
- ❖ The critical importance of the sphere of local government in addressing the many challenges facing our communities, including provision of safe drinking water;
- ❖ The urgent need to improve and strengthen the coordinated actions of national, provincial and local government in key areas of delivery including the delivery of safe drinking water.

Implementation strategies are based on the following key principles:

- ❖ Acknowledgement of all applicable guiding legislation and the Strategic Framework for Water Services (2003);
- ❖ The mandated role of National and Provincial government is to actively pursue both regulatory governance and co-operative government in the water services sector, thereby assisting Local Government in continual improvement;
- ❖ Acknowledgment, support and building on existing successful implementation models (for example in the Free State and Western Cape);
- ❖ DWAF as the sector leader and regulator should intervene proactively and appropriately as required;
- ❖ The quality of Water Services data is to be used to identify needs and guide national programmes such as the Municipal Infrastructure Grant (MIG), the Capacity Building Grant (CBG) and track the efficiency of WSA implemented projects;
- ❖ The Drinking Water Quality Management Regulatory Strategy needs to ensure that it does not '*undermine the executive authority of Local Government, but should set national Norms and Standards and enforce legislation*' (Strategic Framework for Water Services, 2003).

A phased approach should be adopted to ensure that:

- ❖ Areas of severe failure are identified and addressed in the short term;
- ❖ Early wins are secured, thereby demonstrating the inherent value of the approach, and
- ❖ Coordinated development and deployment of the Drinking Water Quality Regulation Strategy over the longer term is possible.

This approach will limit the disruption of existing operational procedures whilst ensuring an effective service to stakeholders.



4.2 SHORT-TERM INTERVENTION STRATEGY

The goal of 'Improved Drinking Water Quality Soonest' will be implemented *via* a number of short-term actions, to be implemented within one year.

Action 1: Highlighting the profile of Drinking Water Quality Management at Provincial Service Delivery Fora

It is proposed that at a provincial level, the profile of Drinking Water Quality Management is raised to drive improved delivery of safe drinking water. Where Service Delivery Fora currently exist, Drinking Water Quality Management is recommended to be formally admitted onto the agenda for attention. Where Fora do not yet exist, it is recommended that they be established to address provincial drinking water quality issues. These Fora should allow for the involvement and full participation of all stakeholders.

A Task Team is proposed to initiate and oversee the formation of the Drinking Water Quality Management Forum, or to modify existing fora to highlight the profile of Drinking Water Quality Management. The Task Team will comprise senior representatives of at least the following key sector members:

- ❖ DWAF Regional Office;
- ❖ Provincial Department of Local Government;
- ❖ Provincial Department of Health, and
- ❖ SALGA.

The Task Team will be led by an agreed 'Lead Agent', with the default Lead Agent being DWAF Regional Office. An alternate Lead Agent may, however, be determined by the Task Team, dependant on the relative strengths and existing sector initiatives.

A number of Fora have been identified where water services and drinking water quality issues are discussed at a Provincial level (Table 1). These Fora can be considered for addressing provincial drinking water quality issues, but awareness may need to be built before the profile of drinking water quality is adequately emphasised.

Table 2: Existing Provincial Water-oriented Fora

Province	Existing Fora	Issues addressed at Fora	Recommended actions
Eastern Cape	❖ Buffalo City and Amatola Water Board Bilateral Forum.	❖ Focus is primarily bulk water services.	❖ Since stakeholder involvement is limited in the existing Forum, implementation of appropriate Task Team and new Forum is recommended.
Free State	❖ Free State Water Sector Forum; ❖ Operations Committee (Free State Water Quality Management Project).	❖ Quarterly meetings to discuss Consultative Audit results & identify problem areas / improvements. ❖ Biannual water quality feedback session.	❖ Forum and Task Team have been implemented. ❖ Evaluate and modify if required.
Gauteng	❖ Water Services Forum; ❖ Water quality meetings.	❖ Monthly meeting to discuss water issues; ❖ Regular meetings to discuss water quality related issues.	❖ Implement Task Team to modify existing Forum.



Province	Existing Fora	Issues addressed at Fora	Recommended actions
KwaZulu-Natal	<ul style="list-style-type: none"> ❖ Catchment Management Forums. ❖ DWAF Masibambane Forum. 	<ul style="list-style-type: none"> ❖ Main focus is protection of water resources. 	<ul style="list-style-type: none"> ❖ Implement Task Team to modify existing Masibambane Forum.
Limpopo	<ul style="list-style-type: none"> ❖ Satellite Management Meeting (DWAF district and top management drinking water quality meetings). ❖ Collaborative Coordinating Committee meetings. 	<ul style="list-style-type: none"> ❖ Monthly meetings comprising largely DWAF officials; ❖ Monthly meeting focussing largely on water & sanitation issues, also infrastructure and transfers. 	<ul style="list-style-type: none"> ❖ Implement Task Team to modify existing Forum.
Mpumulanga	<ul style="list-style-type: none"> ❖ Mpumulanga Joint Operations Committee (MJOC). 	<ul style="list-style-type: none"> ❖ Regular meetings, but DWQM is not a focal agenda item. 	<ul style="list-style-type: none"> ❖ Implement Task Team to modify existing Forum.
Northern Cape	<ul style="list-style-type: none"> ❖ District Municipality Water and Sanitation Sector Forums. 	<ul style="list-style-type: none"> ❖ Focus is primarily sanitation and water infrastructure. 	<ul style="list-style-type: none"> ❖ Implement Task Team to modify existing Forum.
North West	<ul style="list-style-type: none"> ❖ None identified by the stakeholders interviewed. 	<ul style="list-style-type: none"> ❖ 	<ul style="list-style-type: none"> ❖ Implementation of appropriate Task Teams and Forum.
Western Cape	<ul style="list-style-type: none"> ❖ DoH Provincial Liaison Committee meetings, Provincial Environmental Health Forums, Regional Health Forums. ❖ DWAF Masibambane Forum (being established). 	<ul style="list-style-type: none"> ❖ DWQ issues are discussed. 	<ul style="list-style-type: none"> ❖ Task Team and Forum has been implemented. Evaluate Masibambane Forum and modify if required.

(Emanti Management, 2004)

Action 2: Awareness Creation and Communication of Responsibilities for Urgent Cases

A Drinking Water Quality Management Communication Campaign is planned, including:

- ❖ A pamphlet to inform WSAs of their duty to undertake monitoring and communication as dictated by the regulated Compulsory National Standards, as well as the minimum requirements for effective Drinking Water Quality Management;
- ❖ A pamphlet to increase consumer awareness of Drinking Water Quality issues, and
- ❖ Provincial roadshows to communicate the Drinking Water Quality Framework to all sector stakeholders, and obtain feedback to improve the document.

Action 3: Support and Intervention

Where evidence exists that a WSA is providing water of unacceptable quality, or where the WSA is not undertaking any water quality monitoring, the Regional Director: DWAF will communicate *via* a letter to the Municipal Manager pointing out the WSA's responsibilities and offering assistance in a supportive manner. This support will include advising on the WSA's regulatory requirements, provision of an information pack on Drinking Water Quality Management, and provision of practical guidelines for implementation of effective Drinking Water Quality Management. In cases of severe drinking water quality failure, emergency response will also be instituted.



4.3 MEDIUM-TERM INTERVENTION STRATEGY

Drinking water quality will be improved by the implementation of two medium-term actions, to be executed within two to three years:

Action 4: Implementation of Drinking Water Situational Assessments

Action 4a: A once-off baseline assessment of drinking water quality should be undertaken to gather current data from all WSAs as well as to inform them of their requirement to undertake systematic monitoring and communication of drinking water quality results as specified in the regulated Compulsory National Standards.

Action 4b: DWAF is recommended to undertake Drinking Water Quality Management System assessments where a wide-ranging assessment of WSA performance (including the condition of each water treatment works, an assessment of Drinking Water Quality Management practices at each water treatment works, and compliance to national norms and standards) is conducted. This assessment will be used to indicate the level of support required from Provincial & National Government.

Action 5: Initiation of Provincial Drinking Water Quality Consultative Audits

Since many WSAs do not adhere to the Compulsory National Standards for the Quality of Potable Water, a process needs to be initiated by Provincial or National Government to rectify the situation. Consultative audits, similar to those practised monthly in the Free State, are recommended to be initiated in each province - with provincial government undertaking a monthly audit of drinking water quality supplies and communicating the results to the WSA Municipal Manager. Quarterly Consultative Audit meetings are recommended to discuss drinking water quality failures, provide reasons for failures and propose actions to rectify drinking water quality failures.

These co-operative governance-oriented drinking water quality audits will not replace the required drinking water quality monitoring and self-regulation to be undertaken by WSAs or the recommended regulatory audits undertaken by DWAF, but are seen as an interim supportive measure to be undertaken until capacity is built at the local level and Water Services Authorities can undertake their mandated requirements of drinking water quality monitoring, management and communication.

Information arising from the Consultative Audits should be:

- ❖ Communicated to Provincial Drinking Water Quality Management Fora, where the problem areas identified through the above process are discussed and prioritised (ranked). These audits can be used to determine required regulatory intervention, assess progress with achieving drinking water quality compliance, and recommend Municipal Infrastructure Grant (MIG) and Capacity Building Grant (CBG) funding where capacity is lacking.
- ❖ Captured onto a DWAF Drinking Water Quality Management database and made available to interested and affected parties.

4.4 LONGER TERM DRINKING WATER QUALITY MANAGEMENT STRATEGY

To achieve the longer term vision of 'Effective Drinking Water Quality Management Ensuring Safe Drinking Water', WSAs are required to fulfil their mandated requirements of drinking water quality monitoring, management and communication, with DWAF fulfilling the role of National Policy-maker, Supporter and Regulator.

The ideal long-term Drinking Water Quality Management objective is that:

- ❖ WSAs are supported to undertake effective Drinking Water Quality Management from catchment to consumer, using a comprehensive, preventative risk-management approach, ensuring safe drinking water quality and protection of public health. While DWAF/CMAs are responsible for the implementation of national catchment water quality monitoring programmes, WSAs will also need to



undertake reactive water quality monitoring in the upstream catchment during water quality failures to establish the source of the problem.

As verification of the performance of their Drinking Water Quality Management system, WSAs are required to undertake drinking water quality compliance monitoring, at frequencies appropriate to factors such as the population served, the volume of water treated and the frequency of water quality problems. The purpose of this monitoring is to provide confidence in the provision of safe drinking water. However, in recognition of limited capacity within WSAs, the minimum requirements for effective Drinking Water Quality Management are presented in Annexure 3. These minimum requirements include:

- Adequate numbers of appropriately skilled and experienced staff, with staff being comprehensively trained on implementation of effective Drinking Water Quality Management;
- Effective water treatment including clarification (where required) and disinfection processes;
- Operator's manuals detailing operation of the water works under routine and failure conditions;
- Metering of chemical dosages and flows and recording of process information in process logs;
- Effectively implemented Operational Monitoring Programmes and Drinking Water Quality Compliance Monitoring Programmes;
- Adequate monitoring equipment and training on the use of this equipment;
- A method of recording drinking water quality results;
- Access to, and an ability to interpret drinking water quality results against the SANS 241 Drinking Water Quality Specification or Department of Water Affairs and Forestry, Department of Health and Water Research Commission Quality of Domestic Water Supplies, Volume I: Assessment Guide, and
- Planned Maintenance and Upgrade Schedules for Water Treatment Infrastructure, including adequate and timeous budgeting.

Fulfilment of minimum requirements is deemed acceptable for those WSAs classified as having limited capacity. The stronger or better-capacity WSAs are expected to undertake comprehensive Drinking Water Quality Management from catchment to consumer.

- ❖ The Provincial Consultative Audits are gradually phased out in provinces which are demonstrating effective Drinking Water Quality Management. The frequency of consultative auditing is recommended to decrease with increasing conformance to the regulations of the Water Services Act (No. 108 of 1997) monitoring requirements and compliance with the SANS 241 Drinking Water Specification.
- ❖ DWAF, as the sector regulator, is the recommended authority for undertaking Drinking Water Quality Management Regulatory Audits, where a comprehensive assessment of Drinking Water Quality Management is undertaken. These Regulatory Audits will be aligned with the overall Regulatory Strategy for the regulation of Water Services, and are likely to be random and unscheduled, with an emphasis on verified self-reporting by WSAs.
- ❖ Where there is lack of adherence to the monitoring requirements specified in the Water Services Act (No. 108 of 1997), or there is evidence of drinking water quality problems of an acute or chronic nature, it is recommended that DWAF intervene in a proactive manner according to the Drinking Water Quality Regulatory Strategy. In cases of severe drinking water quality failure, emergency response will also be instituted.



4.5 DRINKING WATER QUALITY MANAGEMENT REGULATION: INCENTIVES AND SANCTIONS

The Department of Water Affairs and Forestry is committed to exercise incentive-based regulation but in cases of reluctance or negligence by the WSA management to rectify identified non-compliant activities relating to Drinking Water Quality Management, while being capable of doing so, then punitive actions will be considered. Both supportive measures and punitive actions may be implemented in the short-, medium- and long-term.

To regulate proactively, DWAF will perform assessments of Drinking Water Quality Management procedures at Water Services Provider level to identify areas of non-compliance and draw the attention of the WSA to these areas to prevent failure of drinking water quality. However, it should be noted that it remains the responsibility of the WSA to ensure that the water supplied to its consumers is of safe and acceptable quality and to ensure that treatment and reticulation procedures are of acceptable standards.

4.5.1 Incentives for Drinking Water Quality Compliance

DWAF will use incentives to encourage compliant WSAs to maintain the *status quo*. Proposals for incentives include:

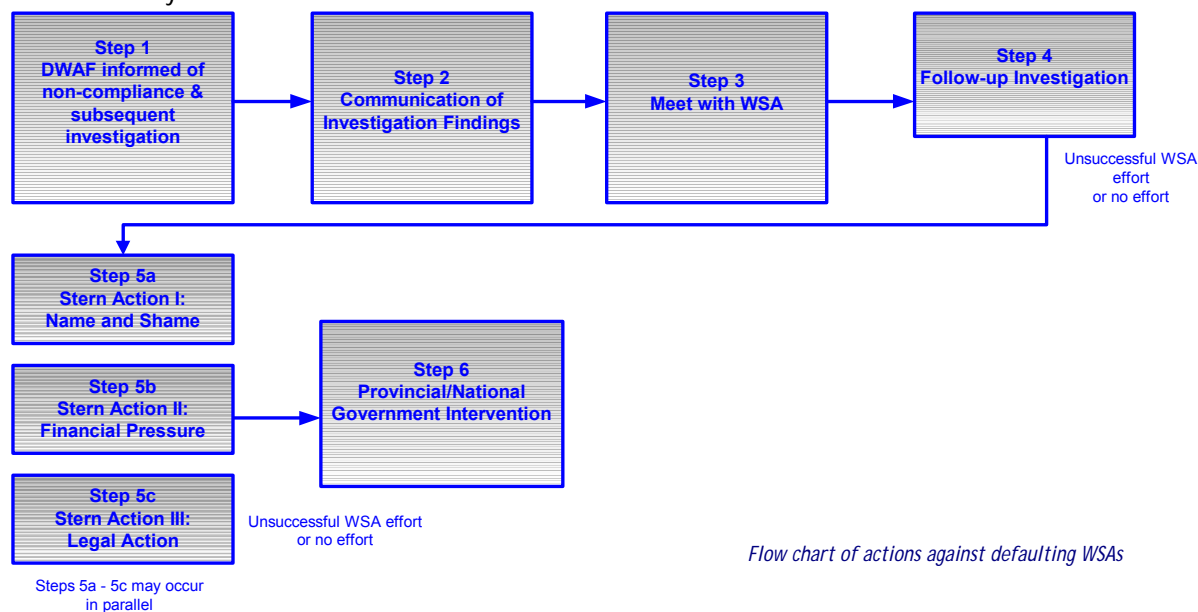
- ❖ Classification and publishing of Drinking Water Quality Management status: The Drinking Water Quality Management classification status could be used by WSAs for benchmarking and marketing purposes. The Drinking Water Quality Management classification status of a WSA could be published on the Internet, in newspapers and WSA Annual Reports;
- ❖ WSAs classified as 'Excellent' could be considered as Drinking Water Quality Management models or examples and could be given a training grant to train, support and mentor lesser-performing WSAs;
- ❖ Letters and certificates of recognition could be presented to WSAs which improve their Drinking Water Quality Management classification status;
- ❖ Competitions could be held for the implementation of the best Drinking Water Quality Management strategies or improvement plans, with winning WSAs being awarded by the Water Institute of Southern Africa (WISA).

4.5.2 Proposed actions against defaulting or negligent Water Services Authorities

Should a WSA fail to meet its legislated obligations regarding service delivery according to the promulgated Norms and Standards under section 9 or 10 of the Water Services Act (No. 108 of 1997), it will be in the best interests of the consumer if the National Regulator follows a defined course of action in order to obtain compliance from the defaulting Authority.



Steps will follow in the numerical sequence as necessary should non-compliance continue despite intervention efforts made by DWAF.



Step 1: Investigation

Since the consumer can be regarded as the most effective monitoring entity, it is expected that the DWAF, in the majority of cases, would be notified by the public of non-compliance, by written correspondence or telephonically. The National Regulator should perform the following:

- ❖ Verify information received through on-site investigation and/or consultation with the WSA. If the onsite investigation indicates a significant problem which seriously endangers public health, the emergency management team should be constituted to rectify the problem;
- ❖ The findings of this investigation must be documented, including dated photographs to emphasise the magnitude of the problem, and captured onto the Regulatory website.

Step 2: Communicate Findings

Communicate the findings of the investigation to:

- ❖ Water Services Authority (formally inform both WSA Management as well as to Council and request compliance);
- ❖ Complainant;
- ❖ Other parties directly affected by the non-compliant activity (including DPLG/Provincial Government, DoH & SALGA), and
- ❖ Relevant DWAF staff (Regional, Cluster and National).

Step 3: Meet with WSA Management

This step includes meeting with Municipal Management and relevant Councillors to explain drinking water quality non-compliance and the repercussions of the action. This must always be done with the support of legislation and appropriate policy (Section 9 & 10 of Water Services Act (No. 108 of 1997)); Strategic Framework for Water Services and the Norms and Standards).

The primary purpose of this meeting would be to negotiate speedy rectification of the non-compliant action/s. The target of the negotiation would be to get the commitment from Municipal Management/Council for speedy rectification; it is therefore important that the outcomes from this meeting are recorded. Reasonable time frames for the WSA to become complaint must be agreed on.



If the outcome of this meeting is that there is a lack of capacity within the WSA which prevents them from delivering services according to promulgated Norms and Standards, then avenues must be investigated via DWAF's Directorate: Local Government Support or Directorate: Sector Development or Municipal Support Programmes of DPLG. The National Regulator is then required to monitor these capacity building actions closely.

Step 4: Follow-up Investigation

An on-site follow-up investigation is required to be performed by DWAF, as the National Regulator, shortly after the due date negotiated in Step 3. Findings are required to be documented, including dated photographs to emphasise the magnitude of the problem.

If the WSA is successful in resolving the problem, then a letter of acknowledgement must be issued to the Mayor and Municipal Management of the WSA. This positive action must also be captured on the Regulatory Information System. However, if the applied effort fails to meet the requirements of compliance, or if no effort was made to change the situation, the Regulator will implement one of the Step 5 options.

Step 5 (a): Stern Action I (Name and Shame)

DWAF, as the National Regulator, are to inform SALGA, DPLG, Provincial Government and National Treasury of the failure of the WSA to be compliant after an intensive negotiation stage, which was regulated in the spirit of co-operative governance.

In order to apply political and public pressure on the Authority to become compliant, the option of 'Name & Shame' may eventually need to be followed. It is, however, important that the WSA be informed of the intention and date of publishing in advance.

Proposed means of 'Name and Shame':

- ❖ Media articles and television documentaries: The responsible official and the Chief Directorate: Communication must ensure that the article or documentary is factual;
- ❖ National State of the Sector Report of Non-compliance: This report would list all non-compliant WSAs, including the extent of non-compliance.

Step 5 (b): Stern Action II (Financial Pressure)

If no satisfactory response is evident after Step 7, Financial Pressure may be applied with the assistance of National Treasury. A possible method could be the retention or holding back of capital funds (as contemplated in the Public Finance Management Act (No. 1 of 1999 as amended by No. 29 of 1999), and the Division of Revenue Act (No. 5 of 2004, promulgated annually). This step may include the imposing of a fine to the municipality which will be reported upon in the Annual WS Regulation Report.

Step 5(c): Stern Action III (Legal Action)

Legal Action is seen as a last resort, requiring documented evidence to prove that National Government has exhausted all means of co-operative governance before taking this step. The National Regulator should endeavour to avoid this step by negotiating and convincing Local Government of its responsibilities. However, as a contingency measure, DWAF (Water Services & Legal Services) must investigate strategies to deal with issues that cannot be solved by means of negotiations. This action may include the issuing of a Directive or Court Interdict.

Step 6: Provincial or National Government Intervention

Prior to this step, DWAF is required to liaise with Provincial Government regarding formal intervention. The initial responsibility of intervention rests with Provincial Government. If all listed avenues have been explored and still the WSA fails to be compliant, then the Minister has to intervene according to Section 63 of the Water Services Act (No. 108 of 1997). This would require the Water Services function to be ring-fenced outside the



financial parameter of the WSA and be managed by the Department of Water Affairs and Forestry. These interventions are required to be coordinated through provincial government and DPLG.

During these steps, the complainant must continuously be informed of the procedures and communications taking place.

At all stages of the intervention, DWAF, as the National Regulator, will ensure compliance with and alignment to the National Regulatory Strategy.

4.5.3 Proposed Capacity-Building and Supportive Measures

Many WSAs in South Africa are overwhelmed by the mandated drinking water quality monitoring and management requirements and thus have difficulty in establishing priorities. The emphasis needs to be on continual improvement, with realistic goals and interim milestones.

Proposed capacity-building initiatives to support WSAs to implement effective Drinking Water Quality Management include:

- ❖ Simple protocols and implementation manuals indicating and prioritising step-by-step actions for effective Drinking Water Quality Management. All manuals should be available in a format and language that the WSA Operator can understand;
- ❖ On-site mentoring demonstrating the use of the implementation manuals by experienced staff from performing WSAs;
- ❖ The introduction of accredited Drinking Water Quality Management training courses for sector stakeholders, with particular emphasis on WSA Operation staff and DWAF Regional Office Water Services staff;
- ❖ Regional DWAF staff (Technical) to be trained to operate in technical advisory capacity. Technical staff are to operate in a technical advisory capacity when requested or when regulatory investigations highlight shortcomings that require communication and rectification. Staff capacity in the DWAF Regional Offices may need to be increased to undertake this support function effectively;
- ❖ DWAF Regional Office Water Services staff assisting WSAs with the prioritisation of maintenance and refurbishment of water treatment infrastructure projects in their Integrated Development Plans, to ensure that these projects are eligible for Municipal Infrastructure Grant funding.

Capacity-building initiatives for Drinking Water Quality Management must be aligned with Local and Provincial Government capacity-building initiatives and grants.



5. INSTITUTIONAL ROLES AND RESPONSIBILITIES FOR EFFECTIVE DRINKING WATER QUALITY MANAGEMENT

This section seeks to briefly introduce the stakeholders in Drinking Water Quality Management in South Africa, provide brief descriptions of specific functions of key stakeholders in Drinking Water Quality Management, and provide a methodology for ensuring effective stakeholder interaction.

5.1 INSTITUTIONAL ROLES AND RESPONSIBILITIES

WATER SERVICES AUTHORITIES

Overview

The primary responsibility for ensuring the provision of water services rests with local government, *via* the constituted Water Services Authority (WSA). A WSA is any municipality that has the executive authority to provide water services within its area of jurisdiction in terms of the Municipal Structures Act (No.118 of 1998) or the ministerial authorisations made in terms of this Act. WSAs include Metropolitan Municipalities, some district municipalities and authorised local municipalities. WSAs have the constitutional responsibility for planning, ensuring access to, and regulating provision of water services to all constituents within their area of jurisdiction. There can only be one WSA in any specific area and water services authority area boundaries cannot overlap.

Drinking Water Quality Management

The WSA has very specific responsibilities and is required to undertake specific actions for Drinking Water Quality Management, as described in the *Compulsory National Standards for the Quality of Potable Water* (2001):

- (1) Within two years of the promulgation of these Regulations, a water services authority must include a suitable programme for sampling the quality of potable water provided to consumers in its water services development plan.*
- (2) The water quality sampling programme contemplated in subregulation (1) must specify the points at which potable water provided to consumers will be sampled, the frequency of sampling and for which substances and determinants the water will be tested.*
- (3) A water services institution must compare the results obtained from the testing of the samples with SABS 241: Specification for Drinking Water, or the South African Water Quality Guidelines published by DWAF.*
- (4) Should the comparison of the results as contemplated in subregulation (3) indicate that the water supplied poses a health risk, the water services institution must inform the Director-General of the Department of Water Affairs and Forestry and the head of the relevant Provincial Department of Health and it must take steps to inform its consumers:
 - (a) that the quality of the water that it supplies poses a health risk;*
 - (b) of the reasons for the health risk;*
 - (c) of any precautions to be taken by the consumers; and*
 - (d) of the time frame, if any, within which it may be expected that water of a safe quality will be provided.**



Every WSA must monitor the performance of Water Services Providers and Water Services Intermediaries within the WSA's area of jurisdiction to ensure that drinking water quality standards and norms are met.

For communities not yet served with potable water within the WSA's area of jurisdiction, WSAs are required to identify and classify unserved communities (according to risk), assess fitness-for-use of the raw water sources and then implement required interventions as part of their responsibility to provide services to all communities within their area of jurisdiction.



WSAs are responsible for provision of services to all communities within their areas of jurisdiction, including those not yet served with potable water

WATER SERVICES PROVIDERS

Overview

A Water Services Provider is any institution that has a contract with a WSA to sell water to that authority. A WSP can also be any institution who has a contract with a WSA to assume operational responsibility for providing water services to one or more consumers (end users) within a specific geographic area. An institution may not operate as a WSP without the approval of the WSA in their area of jurisdiction.

WSP's duties entail providing water services in an effective and efficient manner, striving to meet and exceed recognised best practices. WSPs must publish a consumer charter which is consistent with by-laws and other regulations, and the consumer charter must be approved by the WSA. A WSP must be accessible to consumers and provide the necessary facilities to receive consumer payments queries, complaints and suggestions for improvements. Furthermore, a WSP has a duty to provide information concerning the provision of water services as reasonably requested by Minister, DWAF (the National Water Services Regulator), the relevant province, Water Services Authorities and consumers.

Drinking Water Quality Management

Drinking water supplied by a WSP must be of a quality consistent with regulated standards. Every WSA must monitor the performance of Water Services Providers and Water Services Intermediaries within its area of jurisdiction to ensure standards and norms are met.

WATER SERVICES INTERMEDIARIES

Overview

A Water Services Intermediary is anyone who is obliged to provide water services to another in terms of a contract with the consumer, and where the main purpose of the contract is not the provision of water services (e.g. employment on farm, or property lease contract). However, a Water Services Intermediary has a responsibility to provide a sustainable water service, a quality and quantity that meets any minimum standards prescribed by the Minister and any additional minimum standards prescribed by the relevant WSA.

Drinking Water Quality Management

If a Water Services Intermediary fails in the delivery of an acceptable quality drinking water, the responsible WSA may direct the Water Services Intermediary to rectify its failure.



THE DEPARTMENT OF WATER AFFAIRS AND FORESTRY

Overview

The Department of Water Affairs and Forestry (DWAF) is the national custodian of South Africa's water and forestry resources, and is the overall leader of the water sector. DWAF is primarily responsible for the formulation and implementation of policy and regulations governing the water sector. DWAF has the constitutional cooperative government responsibility to support and strengthen the capacity of local government, and to regulate local government to ensure effective performance of its duties. As sector leader, DWAF has ultimate responsibility for water services provided by local government and manages information to be used for support, monitoring, regulation and planning.

Role of National DWAF in Drinking Water Quality Management

At a strategic level, National DWAF supports and regulates the Drinking Water Quality function and is required to:

- ❖ Develop and maintain a national Drinking Water Quality Framework;
- ❖ Champion and direct sector awareness, collaboration and the alignment of activities;
- ❖ Manage information, including a sector database and information sharing system covering key aspects such as tracking WSA monitoring systems and drinking water quality data;
- ❖ Undertake evaluations to understand holistic Drinking Water Quality Management activities (include SWOT evaluations, infrastructure investment, operation and maintenance);
- ❖ Undertake periodic regulatory audits of the Drinking Water Quality data and management systems of the Water Services Authorities;
- ❖ Ensure availability and optimisation of resources within the water services sector (human, equipment, technical resources, funds);
- ❖ Facilitate adequate WSA budgetary allocations for Drinking Water Quality Management, and demonstrate *via* Case Studies the positive Net Present Value returns to WSAs of improved operation and maintenances resulting from effective Drinking Water Quality Management, and
- ❖ Undertake proactive intervention where necessary (as Sector Regulator).

At a practical support level, National DWAF is required to:

- ❖ Develop appropriate, practical and sustainable technical support documents and tools to assist Drinking Water Quality Management;
- ❖ Facilitate sharing of lessons learned and information exchange of best practice within the sector (creation of a knowledgeable sector);
- ❖ Provide pragmatic, knowledgeable and proactive support to both WSAs and DWAF Regional Offices;
- ❖ Direct specialist technical support to WSAs where necessary, and
- ❖ Trigger adequate WSA budgetary allocations to drinking water quality monitoring, and show *via* Case Studies the positive Net Present Value returns to WSAs of improved operation and maintenance resulting from Drinking Water Quality Management.

Role of DWAF Regional Offices in Drinking Water Quality Management

DWAF Regional Offices support the Drinking Water Quality Management function by:

- ❖ Providing support to WSAs/WSPs including:
 - Proactive technical Drinking Water Quality Management support;
 - Drinking water quality data management;



- Access to DWAF laboratories for guidance in terms of analytical methods and good laboratory practice and commercial laboratories for routine sample analysis;
- Assistance with training of WSA staff in Drinking Water Quality Management functions.
- ❖ Reviewing of Water Services Development Plans, to ensure that drinking water quality monitoring is included;
- ❖ Reviewing and responding to the national Drinking Water Quality Management database regarding the state of WSAs monitoring systems and water quality data;
- ❖ Undertaking periodic regulatory audits of the data and systems of the Water Services Authorities;
- ❖ Undertaking evaluations to understand sector activities;
- ❖ Compliance/Regulatory Auditing and Assessments (including monitoring);
- ❖ Assisting in Lesson Sharing of Best Practices, and the facilitation of mentoring, and
- ❖ Acting as default Lead Facilitator in initiating provincial Drinking Water Quality Management Task Teams and provincial Drinking Water Quality Management Fora.

Future Catchment Management Agencies (CMAs) will be responsible for water resource planning and management at the catchment level, including licensing of water use and discharges, monitoring abstractions and discharges, and overseeing land-use activities. The CMAs will also be responsible for the implementation of the National Monitoring Programmes which monitor resource quality at the catchment level.

The role of CMAs in resource protection as a preventative measure is particularly important in the cases of communities not yet served with potable water. DWAF Regional Water Quality Management Offices fulfill the role of the CMA where these are not yet established.



CMAs have an important role in protection of water resources, particularly in situations where communities are using untreated water for domestic purposes



THE DEPARTMENT OF HEALTH

Overview

The Department of Health (DoH) is responsible for health strategy, policies and practices as well as the development and drafting of legislation and associated regulations. District municipalities have the primary responsibility for health and hygiene education related to water and sanitation services. National and provincial departments will assist in the training of staff to do this work, and in the training and support of community-based hygiene educators and health promoters on water and sanitation projects. Health policies and health and hygiene education are particularly important in the context of the greater vulnerabilities of sensitive individuals and groups affected by HIV/Aids.

Role of National DoH in terms of Drinking Water Quality Management

National DoH supports the Drinking Water Quality Management function by:

- Ensuring that all hospitals and clinics are provided with adequate water and sanitation facilities and that these facilities are operated sustainably and are adequately maintained;
- Directing effective health and hygiene education to be coordinated with the construction and delivery of water and sanitation infrastructure and related services;
- Development of national health-related Key Performance Indicators, targets, measures and systems (some of the Key Performance Indicators will be related to drinking water quality);
- Ensuring adequate training of Environmental Health Practitioners in Drinking Water Quality Management;



- ❖ Ensuring adequate financial resources to support the DoH Drinking Water Quality Management function;
- ❖ Support to health-related outbreaks of waterborne diseases;
- ❖ Reporting of communicable/notifiable diseases, and
- ❖ Providing appropriate medical assistance to affected patients during drinking water quality emergencies, as well as providing information to affected communities.

Role of Provincial DoH in terms of Drinking Water Quality Management

Provincial DoH supports the Drinking Water Quality Management function by:

- ❖ Monitoring and evaluation of Municipal Health Services, including drinking water quality monitoring and the reporting of results according to national Key Performance Indicators;
- ❖ Collection of information on the incidence of waterborne diseases (for example, diarrhoea) and the use of this information to facilitate interventions;
- ❖ Collaboration with the municipal risk-mapping exercise to prioritise interventions. Ensuring collation of information at a Provincial level, and
- ❖ Being the lead 'early warning' authority and execution agents for medical intervention under emergency conditions.

Role of District Municipality and Metropolitan level DoH in terms of Drinking Water Quality Management

District Municipality and Metropolitan level DoH supports the Drinking Water Quality Management function by:

- ❖ Assuming the primary responsibility for health and hygiene education related to water and sanitation services.
- ❖ Undertaking drinking water quality monitoring as a routine audit function at point-of-use. DoH drinking water quality monitoring will focus on health-risk related constituents, particularly indicators of faecal contamination, and
- ❖ In the case of communities not yet served with potable water, Environmental Health Practitioners at District Municipality and Metropolitan level are required to monitor water quality at the point-of-use to assess the success of the WSAs interventions in protecting public health.



THE SOUTH AFRICAN LOCAL GOVERNMENT ASSOCIATION

Overview

The South African Local Government Association (SALGA) represents, renders a service to, and acts in the interests of 284 Municipalities in South Africa. In particular, SALGA represents, promotes and protects the interests of local government, and ensures that the position of local government is articulated.

Drinking Water Quality Management

In terms of Drinking Water Quality Management, SALGA will assist as follows:

- ❖ Provision of a suitably constituted Municipal Drinking Water Quality Management Focus group to make constructive and critical comment on Drinking Water Quality Management guidelines and regulations;
- ❖ Participation in provincial Drinking Water Quality Management Task Teams;
- ❖ Provision of support to local government if required;
- ❖ Assisting in the facilitation, coordination, communication and roll-out of the Drinking Water Quality Framework by WSAs (jointly with DWAF), and
- ❖ Overseeing the inclusion of Drinking Water Quality Management in Ward Committee Manuals.



THE DEPARTMENT OF PROVINCIAL & LOCAL GOVERNMENT

Overview

The Department of Provincial and Local Government (DPLG) has overall responsibility for the affairs of local government. This includes policy, legislation, capacity building, grant allocation and regulation as these apply to the integrated aspects of municipal services provision, including governance, administration, municipal finance and integrated planning. DPLG has the constitutional responsibility to support and strengthen the capacity of local government in the fulfilment of its functions, and to regulate local government to ensure effective performance of its duties. Many of these responsibilities are exerted through provincial governments, *via* the associated Departments of Local Government (DLG).

Role of national DPLG in terms of Drinking Water Quality Management

National DPLG supports the Drinking Water Quality Management function by:

- ❖ Developing and setting supportive policies;
- ❖ Overseeing supportive grant allocations, and
- ❖ In terms of drinking water quality failures/emergencies, the National Disaster Management Centre (NDMC), which functions under the auspices of the DPLG, coordinates emergency actions, where the focus is on crisis management.

Role of provincial DLG in terms of Drinking Water Quality Management

Provincial DLG supports the Drinking Water Quality Management function by:

- ❖ Identification of areas of need within Local Government regarding the achievement of effective Drinking Water Quality Management;
- ❖ Allocation of Municipal Infrastructure Grant, Capacity Building Grant and Equitable Share to address areas of need impacting on effective Drinking Water Quality Management;
- ❖ Implementation of Project Consolidate, with consideration to Drinking Water Quality Management status and information. Project Consolidate is a two year hands-on engagement, capacity development and support programme from the Ministry and Department of Local Government towards local government in key areas of municipal service delivery. Project Consolidate seeks to optimise the impact of local government systems by improved coordinated actions of national government, provincial government, local government and the private sector .
- ❖ Coordination of Provincial Development Plans (and associated Integrated Development Plans) to reflect Drinking Water Quality Management status, needs and outcomes;
- ❖ Initiation of the formation of the provincial Drinking Water Quality Management sector based Task Team and Drinking Water Quality Management Fora in conjunction with DWAF Regional Office if such is absent, and
- ❖ Initiation and implementation of co-operative governance-oriented Drinking Water Quality Management consultative audits where absent.



NATIONAL TREASURY

National Treasury (NT) monitors and regulates the finances of all public bodies. These policies are set out in the Public Finance Management Act (No. 1 of 1999) and the Municipal Financial Management Act (No. 56 of 2003). National Treasury's primary role in respect of local government is to manage the impact of local government fiscal activities on national economic policies and to regulate municipal financial management. National Treasury has a role to play in supporting DWAF and other departments in fulfilling their support and regulatory roles insofar as these roles relate to fiscal and financial matters.

National Treasury may possibly play a role in applying financial pressure to defaulting WSAs.



WATER RESEARCH COMMISSION

The **Water Research Commission (WRC)** is a hub for water-centred knowledge, innovation and intellectual capital in South Africa. The WRC engages stakeholders and partners in solving water-related problems critical to South Africa's sustainable development and economic growth, and are committed to promoting a better quality of life for all.



The WRC is involved in promoting and funding research into Drinking Water Quality Management.



SOUTH AFRICAN ASSOCIATION OF WATER UTILITIES

The **South Africa Association of Water Utilities (SAAWU)** is a collective and representative voice of water boards to ensure commitment and support to the Water Services Authorities in delivering on their mandate.

The SAAWU is committed to proactively engaging with DWAF and the water services sector to support water service delivery issues, including Drinking Water Quality Management. SAAWU can be expected to contribute through their significant pool of specialist expertise and facilities.



CIVIL SOCIETY

Government is committed to promoting the active involvement of civil society in the provision of sustainable and affordable water services, including Drinking Water Quality Management. The Strategic Framework for Water Services (2003) notes that *'the most important and effective monitoring strategy for the sector is strengthening the voice of the consumer'*.



Consumers and other members of civil society can be expected to contribute towards Drinking Water Quality Management by:

- ❖ Reporting drinking water quality failures;
- ❖ Lobbying local government, provincial government and national government for the provision of safe drinking water;
- ❖ Participating in Catchment Management Fora to lobby stakeholders to protect the resource, and
- ❖ Participation in provincial Drinking Water Quality Management Fora.

5.2 SECTOR COLLABORATION

One of the most critical aspects relating to achieving effective Drinking Water Quality Management in South Africa is ensuring effective and meaningful sector collaboration. The principle objective is to create an enabling and supporting environment which fosters collaboration, mutual support and learning. Given that the different provinces of South Africa, with their different areas of strengths and weaknesses within the sector, require provincially based drinking water quality initiatives, a simple, provincially oriented sector collaboration methodology is presented in Annexure 4.

The methodology is based on the effective participation of the sector *via* a provincial Drinking Water Quality Management forum and an associated Drinking Water Quality Management Task Team. The Task Team comprises senior representatives of at least the Regional DWAF office, Provincial Department of Local Government, Provincial Department of Health, and SALGA. The Task Team will be led by an agreed 'Lead Agent', with the default Lead Agent being DWAF Regional Office. An alternate Lead Agent may, however, be determined by the Task Team, dependant on the relative strengths and existing sector initiatives. Importantly, the Task Team should align the initiative with existing provincial sector collaborative initiatives, such as Masibambane or Project Consolidate. The Task Team's first requirement will be to initiate actions for a provincial Drinking Water Quality Management Forum that is inclusive of all sector stakeholders.

Thereafter, the Drinking Water Quality Management Task Team will use a simple stepwise objective oriented methodology to prioritise sector efforts and initiatives to improve Drinking Water Quality Management. The methodology will include Drinking Water Quality Management problem analysis, Drinking Water Quality Management objectives analysis, Drinking Water Quality Management options analysis and agreement, task allocation, and roles and responsibility allocation, and ongoing review and continual improvement.

The above described output oriented sector collaboration *via* the use of provincial Drinking Water Quality Management Task Teams and provincial Drinking Water Quality Management forums will ensure:

- ❖ Identification and ranking of Drinking Water Quality Management needs;
- ❖ Identification of the mechanisms to ensure successful output;
- ❖ Identification of required specialist inputs;
- ❖ Linkage to Provincial Development Framework Plans and Integrated Development Plans;
- ❖ Provincial self-determination in ensuring an appropriate provincial Lead Agent;
- ❖ The clear mapping of roles and responsibilities amongst stakeholders in each province, and
- ❖ Raised Drinking Water Quality Management awareness and sector involvement.



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ANNEXURE 1: MEMBERS OF THE DWQM TASK AND DRAFTING TEAMS

The participation of the Drinking Water Quality Management Drafting and Task Teams in the drafting and review of the Drinking Water Quality Framework is gratefully acknowledged.

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Nozuko Zamxaka	Department of Water Affairs and Forestry: Western Cape



ANNEXURE 2: SANS 241: 2005 DRINKING WATER

Table 1 – Microbiological Safety Requirements

1	2	3	4	5
Determinand	Unit	Allowable compliance contribution ^a		
		95% of samples, min.	4% of samples, max.	1% of samples, max.
		Upper limits		
<i>E. coli</i> ^b or Thermotolerant (faecal) coliform bacteria ^c	count/100 mL	Not detected	Not detected	1
	count/100 mL	Not detected	1	10

^a The allowable compliance contribution shall be at least 95 % to the limits indicated in column 3, with a maximum of 4 % and 1 %, respectively, to the limits indicated in column 4 and column 5. The objective of disinfection should, nevertheless, be to attain 100 % compliance to the limits indicated in column 3.

^b Definitive, preferred indicator of faecal pollution.

^c Indicator of unacceptable microbial water quality, could be tested instead of *E. coli* but is not the preferred indicator of faecal pollution. Also provides information on treatment efficiency and aftergrowth in distribution networks.

Table 2 – Physical, Organoleptic and Chemical Requirements

1	2	3	4	5
Determinand	Unit	Class I (recommended operational limit)	Class II (max. allowable for limited duration)	Class II water consumption period, ^a max.
Physical and organoleptic requirements				
Colour (aesthetic)	mg/L Pt	< 20	20 - 50	No limit ^b
Conductivity at 25 °C (aesthetic)	mS/m	< 150	150 - 370	7 years
Dissolved solids (aesthetic)	mg/L	< 1 000	1 000 - 2 400	7 years
Odour (aesthetic)	TON	< 5	5 - 10	No limit ^b
pH value at 25 °C (aesthetic/operational)	pH units	5,0 - 9,5	4,0 - 10,0	No limit ^c
Taste (aesthetic)	FTN	< 5	5 - 10	No limit
Turbidity (aesthetic/operational/indirect health)	NTU	< 1	1 - 5	No limit ^d
Chemical requirements – macro-determinand				
Ammonia as N (operational)	mg/L	< 1,0	1,0 - 2,0	No limit ^d
				7 years
Calcium as Ca (aesthetic/operational)	mg/L	< 150	150 - 300	
Chloride as Cl ⁻ (aesthetic)	mg/L	< 200	200 - 600	7 years
Fluoride as F ⁻ (health)	mg/L	< 1,0	1,0 - 1,5	1 year



Table 2 – Physical, Organoleptic and Chemical Requirements (continued)

1	2	3	4	5
Determinand	Unit	Class I (recommended operational limit)	Class II (max. allowable for limited duration)	Class II water consumption period, ^a max.
Magnesium as Mg (aesthetic/ health) (Nitrate and nitrite) as N (health)	mg/L	< 70	70 - 100	7 years
	mg/L	< 10	10 - 20	7 years
Potassium as K (operational/health)	mg/L	< 50	50 - 100	7 years
Sodium as Na (aesthetic/health)	mg/L	< 200	200 - 400	7 years
Sulfate as SO ₄ ⁻ (health)	mg/L	< 400	400 - 600	7 years
Zinc as Zn (aesthetic/health)	mg/L	< 5,0	5,0 - 10	1 year
Chemical requirements – micro-determinand				
Aluminium as Al (health)	µg/L	< 300	300 - 500	1 year
Antimony as Sb (health)	µg/L	< 10	10 - 50	1 year
Arsenic as As (health)	µg/L	< 10	10 - 50	1 year
Cadmium as Cd (health)	µg/L	< 5	5 - 10	6 months
Total Chromium as Cr (health)	µg/L	< 100	100 - 500	3 months
Cobalt as Co (health)	µg/L	< 500	500 - 1 000	1 year
Copper as Cu (health)	µg/L	< 1 000	1 000 - 2 000	1 year
Cyanide (recoverable) as CN ⁻ (health)	µg/L	< 50	50 - 70	1 <u>week</u>
Iron as Fe (aesthetic/ operational)	µg/L	< 200	200 - 2 000	7 years ^b
Lead as Pb (health)	µg/L	< 20	20 - 50	3 months
Manganese as Mn (aesthetic)	µg/L	< 100	100 - 1 000	7 years
Mercury as Hg (health)	µg/L	< 1	1 - 5	3 months
Nickel as Ni (health)	µg/L	< 150	150 - 350	1 year
Selenium as Se (health)	µg/L	< 20	20 - 50	1 year
Vanadium as V (health)	µg/L	< 200	200 - 500	1 year
Chemical requirements – organic determinand				
Dissolved organic carbon as C (aesthetic/health)	mg/L	< 10	10 - 20	3 months ^e
Total trihalomethanes (health)	µg/L	< 200	200 - 300	10 years ^f
Phenols (aesthetic/health)	µg/L	< 10	10 - 70	No limit ^b
^a The limits for the consumption of class II water are based on the consumption of 2 L of water per day by a person of mass 70 kg over a period of 70 years. Columns 4 and 5 shall be applied together. ^b The limits given are based on aesthetic aspects. ^c No primary health effect - low pH values can result in structural problems in the distribution system. ^d These values can indicate process efficiency and risks associated with pathogens. ^e When dissolved organic carbon is deemed of natural origin, the consumption period can be extended. ^f This is a suggested value because trihalomethanes have not been proven to have any effect on human health.				

Table A.1 – Suggested minimum frequency of sampling (Water Works Final sample)

1	2
Population served	Frequency ^a min.
More than 100 000	10 every month per 100 000 of population served
25 001 - 100 000	10 every month
10 001 - 25 000	3 every month
2 500 - 10 000	2 every month
Less than 2 500	1 every month
^a During the rainy season, sampling should be carried out more frequently.	

SANS 241: 2005: *Drinking Water*, Edition 6.



ANNEXURE 3: MINIMUM REQUIREMENTS FOR EFFECTIVE DRINKING WATER TREATMENT

Minimum requirements for effective drinking water treatment focus on the Water Treatment Works component of the catchment to consumer approach under normal conditions, but include reactive consideration of catchment and source water and reticulation issues under acute or chronic drinking water failure conditions.

STAFF

Adequate numbers of appropriately skilled and experienced staff according to the Water Act Regulations for the Registration of Waterworks and Process Controllers - in the process of being revised) are required to operate and supervise the Drinking Water Treatment Works. This includes the Class of Operator and Supervisor required, and depends on a number of factors, including the population served, the design capacity of the water works, the complexity of the water treatment process and the variability of the raw water. Since water treatment is considered to be an essential service, workers are not allowed to strike, and backup staff are always required to be available.

Water works operational staff also require appropriate Drinking Water Quality Management training. This training is required to be comprehensive and should at least include:

- ❖ An understanding of the requirements of preventative Drinking Water Quality Management from catchment to consumer;
- ❖ Knowledge of treatment processes required to produce safe drinking quality;
- ❖ Operating procedures under routine and drinking water quality failure conditions;
- ❖ Sampling procedures and use of monitoring equipment to enable collection of representative samples, and
- ❖ Interpretation of drinking water quality results against the SANS 241 Drinking Water Quality Specification or DWAF, DoH and WRC Quality of Domestic Water Supplies, Volume I: Assessment Guide.

TREATMENT

In general, the following treatment processes are required as a minimum:

- ❖ Clarification processes that are used to remove suspended material from the water, including coagulation, flocculation, sedimentation and filtration.
- ❖ Disinfection processes, including chemical treatment with chlorine or chlorine compounds.

When treating groundwater with low amounts of suspended material, clarification may not be required, but disinfection would be recommended as a minimum preventative/protective measure to avoid subsequent drinking water quality failures in the distribution system. Boreholes and other sources of groundwater should be protected to minimise contamination.

Additional information on treatment of water to render it safe to drink may be found in the Department of Water Affairs and Forestry, Department of Health and Water Research Commission Quality of Domestic Water Supplies, Volume I: Treatment Guide. (<http://www.dwaf.gov.za/iwqs/report.htm>)

An Operator's Manual specific to the Water Treatment Works is essential and should contain the following information:

- ❖ Routine Operating Procedures.
- ❖ Process Control Techniques applicable to the water treatment works, for example jar tests, cascade tests, analysis of pH, chlorine and turbidity at appropriate control points.
- ❖ Procedures under Incident or Failure conditions where a loss of process control has occurred, and
- ❖ Internal operating targets for key water quality constituents such as turbidity and free chlorine.



The Operator's Manual should be available in a form and language that the Operator can understand. Accurate metering of chemical dosages and flows through the Water Treatment Works is required, with a process log recording this information, including an Operator signature, date and time.

DRINKING WATER QUALITY MONITORING PROGRAMMES

Drinking Water Quality Monitoring Programmes are required for both Operational Monitoring and Drinking Water Quality Verification/Compliance Monitoring. The ability to design Drinking Water Quality Monitoring Programmes (representative constituents, sample sites and frequencies) is thus required.

Data from Operational Monitoring is used to trigger short-term corrective actions to operational procedures.

Considerations for Operational Monitoring Programmes:

- ❖ Constituents monitored should include critical process control variables such as pH, residual chlorine and turbidity. Microbiological analyses (including coliforms and *E. coli*) should also be undertaken as a minimum requirement when operational monitoring indicates a loss of process control or in response to consumer complaints.
- ❖ Sampling points should include at least the raw water intake, the water works final water, distribution reservoirs and strategic sites within the reticulation network.
- ❖ Sampling frequency will depend on population served, the volume treated by the water works, the variability of the raw intake water and the frequency of drinking water quality failures experienced. Sampling, should, however, be frequent enough to detect a loss of process control and enable implementation of corrective action before a significant drinking water failure occurs. Recommended minimum frequencies for operational monitoring at the water works (including raw water intake) is daily monitoring, with weekly monitoring undertaken within the distribution network.

Appropriate process control points for operational monitoring are required to be assessed for each water treatment works. This will ensure any process problem can be identified and actioned early in the process to avoid a failure in the final drinking water.

Turbidity on a conventional water treatment works should be measured at the following points:

- ❖ Raw water to monitor variability in the incoming turbidity and altering dosage if automatic control is not instituted. This to be used in conjunction with jar and cascade tests;
- ❖ Post clarification turbidity to ensure correct functioning of the coagulant, flocculation and settling process;
- ❖ After filtration to monitor filter operation (either individually or on a combined basis), and
- ❖ Final water leaving the water treatment works to ensure quality is maintained in storage.

Similar control points should be established for the other process control constituents.

Drinking Water Quality Verification/Compliance Monitoring is the final check that the barriers and preventative measures implemented to protect public health are working effectively and is usually a comprehensive assessment of drinking water quality to assess compliance with regulatory requirements. It is recommended that, as a minimum, for Water Treatment Works treating both surface and groundwater, a SANS 241 constituent list for health-related determinands is analysed for at least once, prior to commissioning of the water works, and then every 3-5 years thereafter.

Minimum constituent lists and frequencies recommended by the SANS 241 Drinking Water Specification or the DWAF, DoH and WRC Quality of Domestic Water Supplies : Volume II - Sampling Guide should be adhered to.



DRINKING WATER QUALITY MONITORING EQUIPMENT

A knowledge of Drinking Water Quality Monitoring sampling procedures is a minimum requirement. This is important as incorrect sampling procedures and methods can affect the accuracy and reliability of analytical results and lead to misleading conclusions on the quality of the water supply.

Sampling equipment:

- ❖ A sample tap, or alternately dip sampling equipment which must be sterilized;
- ❖ Gas burner/alcohol for flaming/disinfecting the tap before sampling;
- ❖ Sample bottles and preservatives appropriate to constituents to be analysed (for example, sterile bottle and sodium thiosulphate for bacteriological samples);
- ❖ Cooler boxes and ice packs for transporting microbiological samples, and
- ❖ Sample labels detailing the sample point number, date and time of sampling and the name of the sampler.

Measurement of pH (where pH correction is undertaken):

- ❖ pH meter, or pH indicator strips;
- ❖ Buffer solutions (buffers 7 and 10 for potable water), and
- ❖ Planned calibration schedule.

Measurement of turbidity:

- ❖ Turbidity meter;
- ❖ Standards for calibration (for example, Gelex/Formazin), and
- ❖ Planned calibration schedule appropriate to standards used.



Measurement of chlorine residual:

- ❖ Equipment suitable for measuring free and total chlorine concentrations in drinking water (for example, Chlorine comparator and discs, DPD 1 & 3 tablets and glass cuvettes).

Jar and cascade testing:

- ❖ Jar test equipment, 1 litre jars, measuring glassware (pipettes, measuring cylinders), stop watch, test coagulant, Whatman No. 1 filter paper or equivalent, funnels, floc size comparator.



Laboratory:

- ❖ Access to a Laboratory, preferably SANAS accredited, is a minimum requirement. Quick (24-hour) turn-around time for bacteriological analyses is required.

Access to a laboratory is a minimum requirement for Drinking Water Quality Management

Additional information on requirements for drinking water quality sampling and analysis can be found in the Department of Water Affairs and Forestry, Department of Health and Water Research Commission guides on the **Quality of Domestic Water Supplies**:

- ❖ Volume II: Sampling Guide;
- ❖ Volume III: Analysis Guide.

(<http://www.dwaf.gov.za/iwqs/report.htm>)



RECORDING AND INTERPRETATION OF DRINKING WATER QUALITY DATA

Data or log sheets, a Laboratory/Field Analysis Results book or simple Excel spreadsheet needs to be set up to **record drinking water quality results**. Electronic data sheets are recommended to be printed regularly to ensure that a paper record is kept.

Knowledge of, and access to the **SANS 241 Drinking Water Specification** is thus an essential requirement for effective Drinking Water Quality Management. This includes an ability to interpret drinking water quality results against the Specification.

Additional information on drinking water quality assessment and data interpretation can be found in the Department of Water Affairs and Forestry, Department of Health and Water Research Commission **Quality of Domestic Water Supplies, Volume I: Assessment Guide**.

(<http://www.dwaf.gov.za/iwqs/report.htm>)

PLANNING AND MANAGEMENT

Planning is one of the most important management functions to ensure the production of safe drinking water quality on a sustainable basis. A **Planned Maintenance and Upgrade Schedule** for Water Treatment Infrastructure, including adequate and **timeous budgeting** is thus essential to ensure sustained effective Drinking Water Quality Management.

In addition to the maintenance of equipment and infrastructure, prompt attention also needs to be given to **mechanical failures** to ensure effective operation of the water works and the production of safe drinking water.

An **assured supply** of water treatment chemicals and other operational consumables is a minimum requirement for effective Drinking Water Treatment. This requires efficient and effective administrative and procurement practices.

According to National Water Act Section 22, the water use needs to be permissible. This may require a **water use authorisation**. Two relevant water uses are s21(a) taking water from a resource, and s21(b) storing water. Water use can be either a General Authorisation, an existing lawful use or a License. It is a minimum requirement that all water treatment works have the correct water use authorisation.



Planned maintenance of Drinking Water infrastructure is essential for the sustainability of drinking water treatment systems



ANNEXURE 4: SECTOR COLLABORATION METHODOLOGY

BACKGROUND

Recognising -

- ❖ Since 1994 enormous progress has been made in providing basic services, including drinking water and sanitation;
- ❖ Notwithstanding progress, service delivery backlogs still exist in key areas including the provision of safe drinking water;
- ❖ The sphere of local government is critical to efforts of addressing the many challenges facing communities, including provision of clean safe drinking water, and
- ❖ There is an urgent need to improve and strengthen the coordinated actions of national, provincial and local government in key areas of delivery including the delivery of clean safe drinking water.

Bearing in Mind -

- ❖ The need for efficient and effective municipalities to deliver improved water services;
- ❖ The role of DWAF, as the lead institution for the management and regulation of water services including drinking water quality;
- ❖ The role of DoH, as the lead institution for health risk management and related awareness;
- ❖ The role of province, and especially provincial Department of Local Government, to directly support municipalities in their areas of jurisdiction, including support relating to infrastructure, equitable share, management and capacity building;
- ❖ The importance of the three spheres of government to work together in an integrated manner, and the importance of effective inclusion of key stakeholders and partners;
- ❖ That the different provinces, with their different areas of strengths and weaknesses within the sector, require provincially based drinking water quality initiatives (including the choice of a Lead Agent and the tailoring of province specific strategies);
- ❖ The existence of various related and provincially based Sector Fora, including Project Consolidate and Masibambane, and
- ❖ The need for simple effective, hands-on mechanisms and support programmes to guide sector collaboration to address the challenge of delivering clean safe drinking water.

And in Order to -

- ❖ Provide for a system of co-operative governance and management of water services, within national guidelines, norms and standards, in which each province and municipality must address delivery of quality water services provision;
- ❖ Ensure that our municipalities have suitable and efficient water services management, including safe drinking water;
- ❖ Fast track interventions in rural and urban nodes and municipalities to ensure accelerated improvement in the provision of safe drinking water, and
- ❖ Put in place Output Oriented performance milestones that will include performance monitoring and evaluation, as well as effective communication on delivery in the provision of safe drinking water.

This guideline presents a practical methodology to initiate and guide sector collaboration in effectively addressing Drinking Water Quality Management.



OBJECTIVE

The presented methodology is intended to achieve the primary objective by fast tracking improvements in drinking water quality. The simple-to-use tool:

- ❖ Ensures effective stakeholder involvement;
- ❖ Identifies current constraints;
- ❖ Converts constraints into allocatable tasks;
- ❖ Maps roles and responsibilities for a particular province, and
- ❖ Allows all stakeholders to track and review progress, thereby ensuring continual improvement.

FORMATION OF PROVINCIAL DRINKING WATER QUALITY MANAGEMENT FORUM

At a provincial level, a Drinking Water Quality Management Forum will be created to initiate and drive improved delivery of safe drinking water (where such Fora exist, drinking water quality needs to be formally admitted onto the agenda for attention). The Drinking Water Quality Management Forum should allow for the involvement of all stakeholders, and the formation thereof should include consideration of the following:

Formation of Drinking Water Quality Management Task Team

The Task Team function is to initiate and oversee the formation of the Drinking Water Quality Management Forum. The Task Team will comprise senior representatives of at least the following key sector members:

- ❖ DWAF Regional Office;
- ❖ Provincial Department of Local Government;
- ❖ Provincial Department of Health, and
- ❖ SALGA.

The Task Team will be led by an agreed 'Lead Agent', with the default Lead Agent as DWAF Regional Office, but an alternate Lead Agent may be determined by the Task Team, dependant on the relative strengths and existing sector initiatives.

The Task Team may choose to align the initiative with an existing provincial sector collaborative initiative, such as Masibambane or Project Consolidate.

Stakeholder involvement in Drinking Water Quality Management Forum

Stakeholders are people, groups, institutions etc which are affected by drinking water quality. A simple but thorough process of stakeholder Analysis should be carried out by the Task Team, and should include:

- ❖ Identification of Key Stakeholders;
- ❖ Assess Stakeholder interests and note the potential impact of the project on these interests;
- ❖ Assess stakeholder influence and importance;
- ❖ Outline a participation strategy, and
- ❖ Acknowledge the dynamic nature of stakeholder involvement (see Figure 1 overleaf) in which inputs and involvement from different interacting stakeholders will vary.

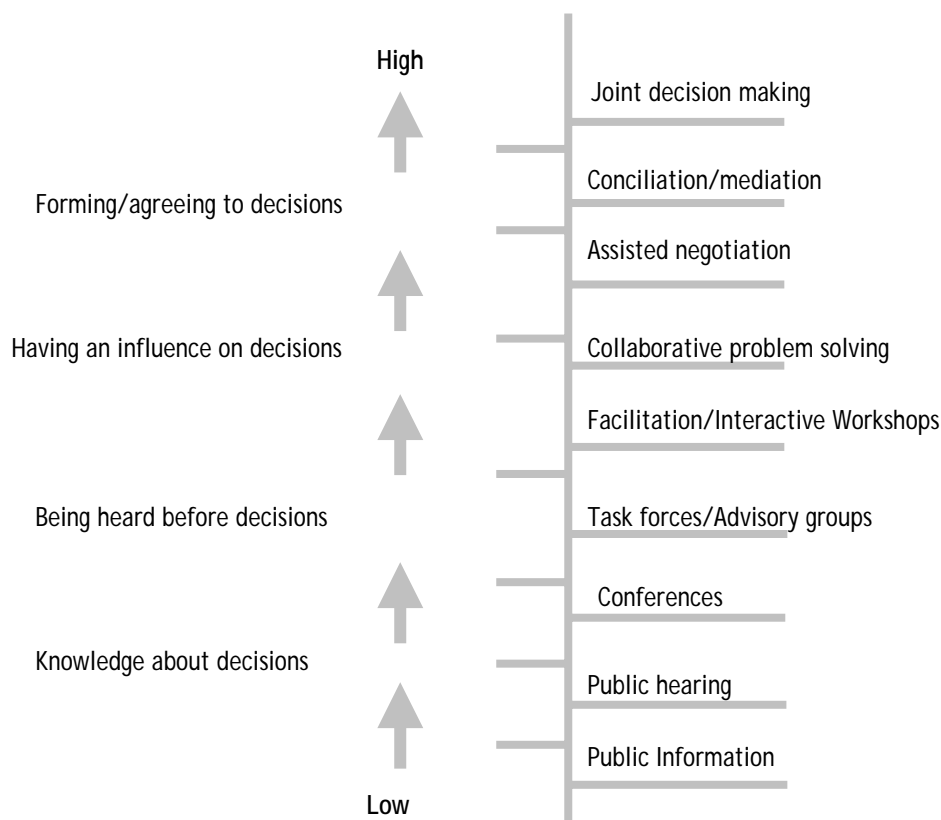


Figure 1: The degree of stakeholder involvement and methods for involvement (to be determined on a provincial basis by each Drinking Water Quality Management Forum).

IMPROVING DRINKING WATER QUALITY V/A PROVINCIAL DRINKING WATER QUALITY MANAGEMENT FORUM

In response to the significant challenge of addressing water services challenges, a means to prioritise efforts and initiatives is required. The presented methodology is used by way of example, and is simple and useful to both the Drinking Water Quality Management Task Team and the Drinking Water Quality Management Forum. It should be able to guide and mobilise sector involvement in developing and implementing sustained actions to prevent, reduce, control and/or eliminate the delivery of unsafe drinking water from municipal water supply systems.

The methodology consists of the following main stages:

- ❖ Problem Analysis;
- ❖ Objectives Analysis;
- ❖ Options Analysis and Agreement;
- ❖ Task Allocation and Roles and Responsibility Allocation, and
- ❖ Ongoing Review and Continual Improvement.

The methodology is outlined in figure 2 overleaf, and described further in the following section.

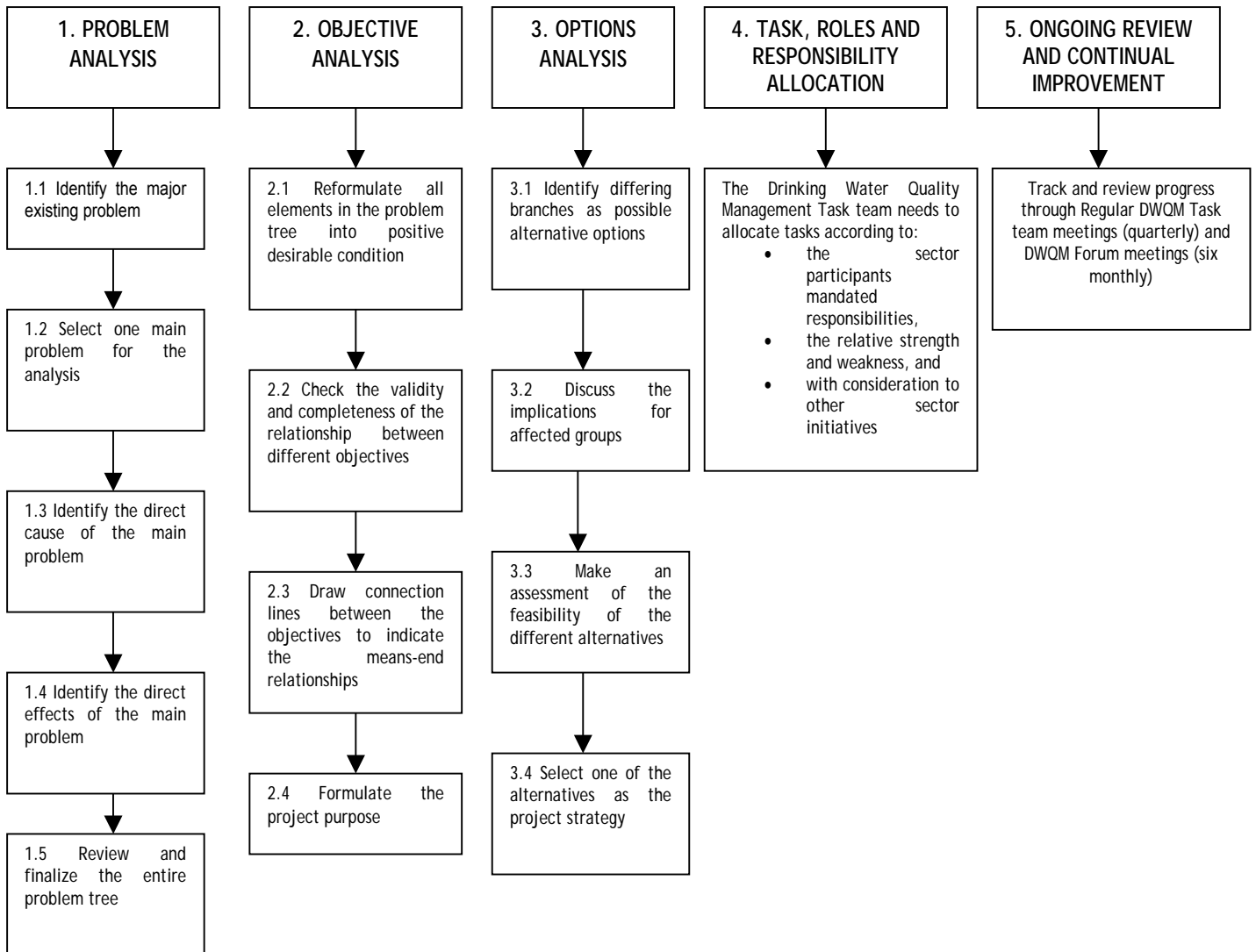


Figure 2: Iterative Problem analysis and Resolution methodology



Problem Analysis

The Drinking Water Quality Management Task Team should carry out a Provincial Problem Analysis relating to drinking water quality. With time the Problem Analysis process will become of an iterative nature, driving continual improvement.

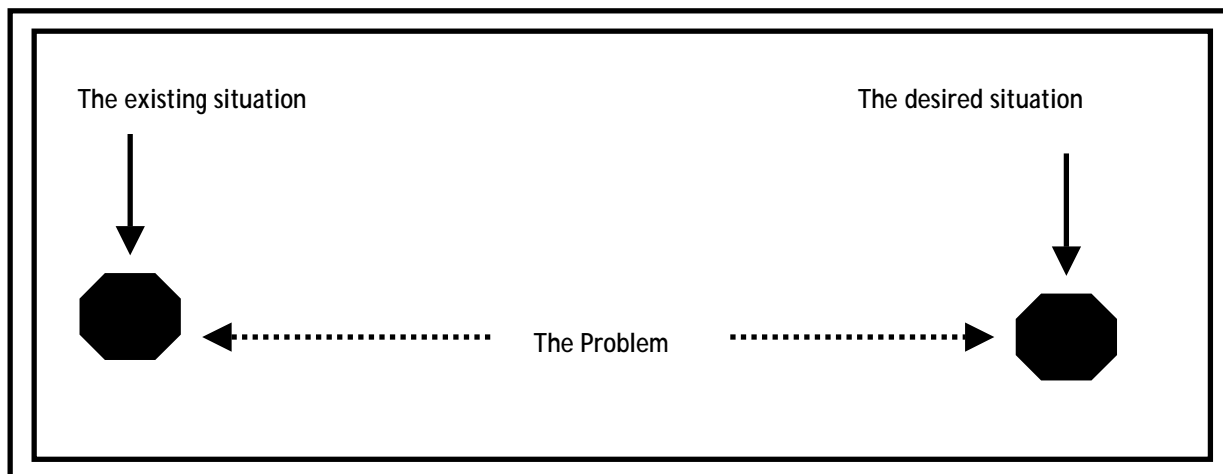


Figure 3: Problem Analysis

The following 5 basic steps should be followed in the Problem Analysis process:

Step 1: Identify the Major Existing Problems

At the start, using what Base Line studies are available, identify the major existing drinking water quality problems that exist (identify only existing problems, not possible/potential/future problems). One of the identified problems may be the lack of a base-line study (this especially applies to what in reality exists at WSA level, ie accurate understanding of the Municipal Retail Function).

Step 2: Select One Main Problem For The Analysis

Identify the Main Root Problem, or the focal problem that you will try to remedy (for example, WSAs are not monitoring drinking water quality).

Step 3: Identify the Direct Causes of the Main Problem

Having identified the Main Root Problem, develop a Problem Tree. At this stage the problem tree will allow us to give a clear overview of the different causes and effects of the main problem (for example, WSAs are constrained by illiterate staff, no onsite monitoring equipment).

Step 4: Identify the Direct Effects of the Main Problem

This step is similar to the previous step. However, instead of looking at the cause of the problem, you look at the effects of the problem. Having identified the Main Root Problem, develop a Problem Tree that provides a clear overview of the different causes and effects of the main problem. (for example, drinking water quality is poor, etc).

Step 5: Review and Finalise the entire Problem Tree

In the final step the entire problem tree should be reviewed to ensure validity and completeness. The tree should read like a logical sequence of cause and effect (or if-then) relationships. On the basis of the problem analysis the Task Team can identify what problems they will try to address, and how this will influence the main problem identified. **Note:** this could be done at Provincial, District Municipality and Local Municipality level as required.

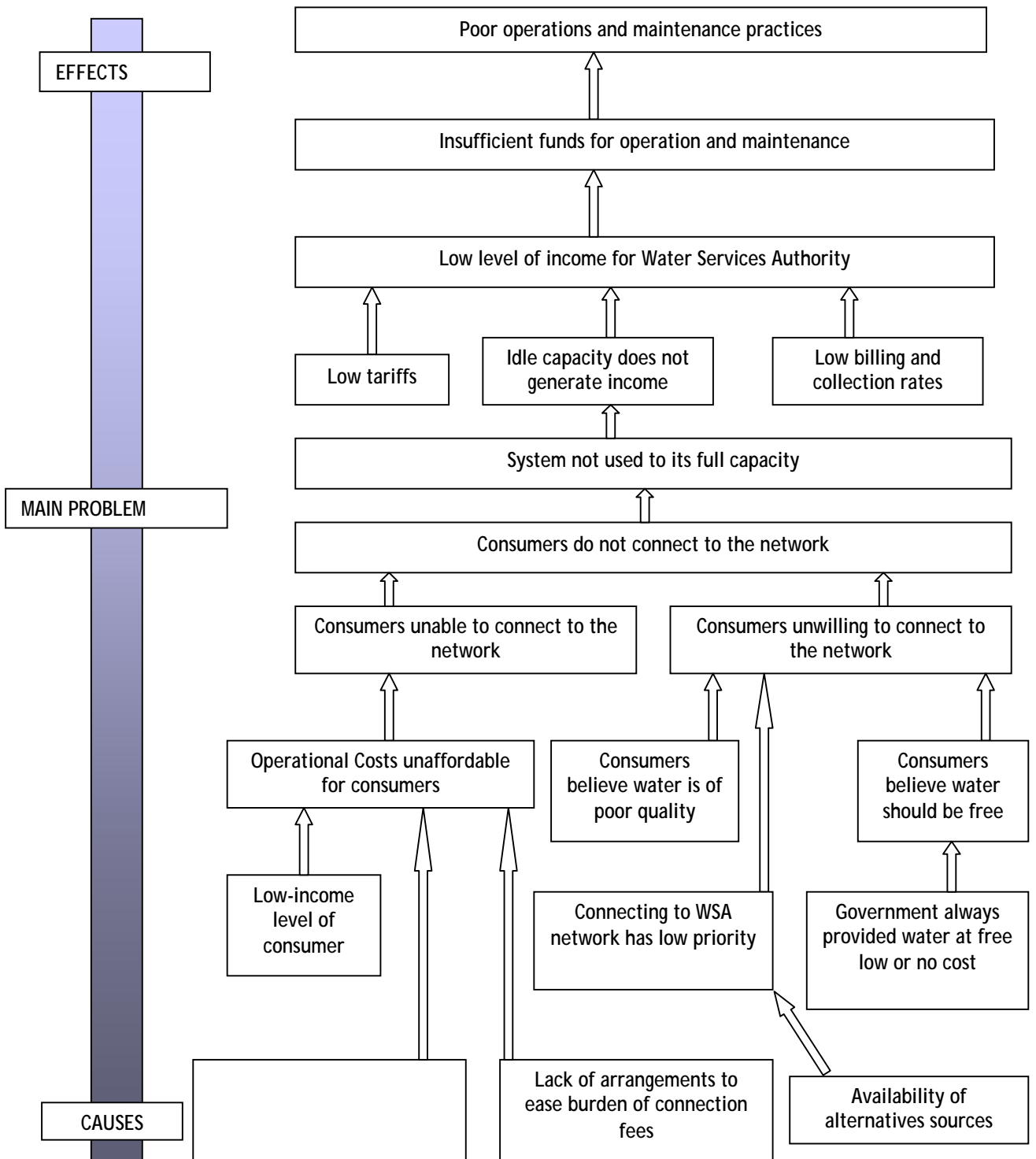


Figure 4: Example of a Problem Tree: where the main problem has been that consumers do not connect to the network



Objective Analysis

The Drinking Water Quality Management Task Team should oversee the conversion of the **problem tree** into a **tree of objectives**, where the problems can be translated into bite sized, solvable objectives (for example, provide pH and free chlorine measurement equipment to water treatment plants and train staff). The following steps have to be taken:

1. Reformulate all elements in the problem tree into positive desirable conditions. This changes the relationship between the different factors from a cause-effect relationship to a means-end relationship.
2. Check the validity and completeness of the relationships between the different objectives. If necessary revise statements, delete objectives that appear unrealistic, and add new objectives where necessary.
3. Draw connection lines between the objectives to indicate the means-ends relationships.
4. Formulate the project purpose. Once all the objectives have been placed in the objective tree it is necessary to decide upon the objectives, which the project/interventions will seek to achieve.

Options Analysis

Once the objectives have been identified, it is necessary to decide upon the way in which these objectives will be achieved. For this purpose an options analysis has to be undertaken. The purpose of the options analysis is to identify alternative options, assess their feasibility and agree upon a one problem focused strategy.

It is crucial to discuss the alternative options together with the stakeholders and to come to agreement on the most favoured option.

The following steps have to be taken:

1. Identify differing 'means-ends' branches as possible alternative options or project components;
2. Discuss the implications for affected groups;
3. Make an assessment of the feasibility of the different alternatives;
4. Select one of the alternatives as the project strategy.

In order to make sure that the proposed strategy is widely supported it is beneficial to include the various stakeholders in the selection of the preferred project strategy.

Task Allocation and Roles and Responsibility Mapping

Once the selected alternative(s) have been identified and prioritised, it is necessary to decide upon the way in which these objectives will be achieved. The Drinking Water Quality Management Task Team needs to allocate these according to:

- ❖ The sector participants mandated responsibilities;
- ❖ The relative strengths and weaknesses, and
- ❖ With consideration to other sector initiatives.

Simultaneously the sector participants agreed Roles and Responsibilities should be mapped.

Ongoing Review And Continual Improvement

Regular Drinking Water Quality Management Task Team meetings (suggested as being quarterly), and Drinking Water Quality Management Forum meetings (suggested as being six monthly), will be used to track and review progress and generally ensure a process of Continual Improvement to the satisfaction of all sector stakeholders.



SUMMARY AND CONCLUSIONS

In summary, the formation of a Provincial Drinking Water Quality Management Forum and an associated Drinking Water Quality Management Task Team combined with usage of a simple stepwise objective oriented methodology (consisting of problem analysis, objectives analysis, options analysis and agreement, task allocation and roles and responsibility allocation, and ongoing review and continual improvement) ensures the following:

- ❖ Identification of needs;
- ❖ Identification of required specialist inputs;
- ❖ Identification of the How (who, what, when, budget) - mechanisms to ensure output;
- ❖ Linkage to Provincial Development Framework Plans and Integrated Development Plans;
- ❖ Provincial self-determination of provincial Lead Agent;
- ❖ Mapping roles and responsibilities in each province, and
- ❖ Simple 'output oriented' process.